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REVIEW OF THE WORK OF THE ROYAL BOTANIC GARDENS, KEW, DURING 1949.

General

The Director continues to serve on the various bodies to which reference has been made in previous reports. His period of office as a member of the Council of the Royal Horticultural Society terminated in February. The Director was again appointed a Vice-President of the Royal Society and Vice Chairman of the Agricultural Improvement Council, he has also served during the past eighteen months as Acting Chairman of the Colonial Agricultural Research Committee. As Fullerton Professor of the Royal Institution the Director delivered a course of four lectures on the Geographical elements in the British Flora and an evening discourse on the subject of " Leaves ".

On July 9th the Director left for Australia as leader of a British Delegation appointed by the Agricultural Research Council to attend the Commonwealth Conference on Nutrition held in Adelaide during August. Prior to the Conference itself he had the opportunity of discussions with the Governor of Western Australia, the Premier and the Minister of Agriculture and was able to make recommendations respecting the provision of a botanical garden there. A potential site for such was inspected which would serve admirably to establish a collection of the extremely rich and scientifically interesting native flora. The Government Botanist, Mr. Gardner is doing first class work and has amassed a most valuable herbarium, but this is quite inadequately housed under conditions so cramped as to seriously hamper the work, and which present a high fire risk. Moreover, the wholly insufficient assistance which Mr. Gardner can command impairs progress on a flora of which the State has every right to be proud and this condition of affairs is moreover wasteful of the services of the Government Botanist whose remarkable knowledge of the flora was manifest in a trip of six days that the Director was able to make in his company to the arid areas in the regions of Merridin, Southern Cross and Wogan Hills. At the end of the Director's tour he made a second trip in Mr. Gardner's company to the south western parts of Western Australia to see the giant Gum forests and *Cephalotus* in its native haunts. During this trip the Director found *Phylloglossum* in a new locality and some very rare endemic species were seen in bloom including *Hodgsoniola junciformis*.

Before leaving Perth the Director visited the University where he and his colleagues were entertained by the Vice-Chancellor and the Director gave an address to the University Staff.

The Nullabor plain was crossed by train and after flying from Adelaide to Melbourne the Director and some of his colleagues made a tour of inspection of the irrigated areas of the Murray valley where examples of various mineral deficiencies were exhibited and various research establishments were inspected.

During the Conference at Adelaide the Director visited the Botanical Gardens under the admirable care of Mr. Lothian with whom he discussed his problems. The Curator's chief difficulty is lack of space rendered more acute by the replication of common species of trees. On the evening of August 24th the Director delivered a public lecture on Kew Gardens and it was gratifying to find how widespread was the interest in our Institution. Before leaving Adelaide the Director paid his respects to the doyen of Australian botany, Mr. Black, the 94 year old author of the South Australian Flora, who it was a pleasure to find actively engaged on the second edition.

After the Congress there was an official tour of some 1,200 miles to inspect features of agricultural interest in the course of which the Melbourne Botanic Gardens were visited. Here the Herbarium in charge of Mr. Jessop is the best housed in the Commonwealth but there is an inadequate staff. The garden of some 100 acres has a considerable collection of trees and shrubs including a number of native species. When there the Director was requested to plant a *Podocarpus* to commemorate his visit. Before leaving Melbourne a day was spent in the admirable national reserve with Mr. Jessop.

The Conference meetings terminated at Canberra and here also the Director delivered a lecture and together with the Premier, Mr. Chiffley, was invited to plant a tree on the site of what is to be the Commonwealth Botanical Garden. This site was inspected and its potentialities discussed with Mr. Pryor, whose knowledge and enthusiasm can be relied upon to develop this beautiful area as a sanctuary primarily for the rich Australian Flora. At Melbourne the Director, as Chairman of the Forest Products Research Committee in this country, paid a visit to the Forest Products Research Institute of the C.S.I.R.O.

The Director travelled by plane to Sydney where under Mr. Anderson's guidance he explored the gardens and visited the Herbarium. Both these require more accommodation for though the Botanical Gardens appear not unduly cramped much of the space they occupy has so shallow a soil above the rock that it has a very limited value. Two of the State Nature Reserves were visited in company with Mr. Anderson and members of Staff and the Chief Ranger. These magnificant areas of many thousands of acres embrace a rich flora and provide national monuments of the first importance with potentialities for scientific investigation that it would be difficult to over-rate and folly to ignore. The far sighted policy that led to their reservation by the State cannot be too highly praised. The universities and several of the agricultural institutions were visited and here as elsewhere opportunities afforded of discussion with Ministers and other officials concerning educational and scientific problems.

From Sydney the Director flew to Brisbane whence an extended tour was made under the guidance of Dr. Summervill and Prof. Herbert to visit the sugar cane areas and the tropical forest research station at Maroochy, where investigations are carried out on the breeding of Pineapples and Pawpaw in particular. The Director also visited the magnificent forest reservation which is the native home of *Araucaria cunninghami*, as well as the Wheat Research Station and the soil erosion experimental station.

The Herbarium at Brisbane has accommodation that is far too small which is the more unfortunate having regard to the ability of the Government Botanist, Mr. C. T. White. The co-called Botanical Garden was some years back handed over to the City so that it has become more a public park than a scientific adjunct and unless it be again taken over by the State and placed under the care of the Government Botanist, it is unlikely that it will fulfil its proper function.

A day was spent with Mr. White and his assistant, Mr. Francis, on Mt. Glorious, where there is a fine example of tropical rain forest rich in number of arborescent species and with more epiphytes than might be expected with only about 60 ins. of rainfall. The Director returned by plane from Brisbane to Adelaide on 27th September and traversing the Nullabor plain once more by train spent a further week in Western Australia, as already mentioned. The total distance traversed by air, by rail, and especially by car, amounted to many thousands of miles and not only was a large area thus visited but the arrangements made by the officials of the C.S.I.R.O. by the Governors and Ministers and their staffs in the various States of the Commonwealth were so thorough and all these and other officials gave so generously of their time that it became possible to meet and discuss problems with many of those most actively concerned with science and agriculture over a range of interests that in retrospect is almost incredible.

The names mentioned in this account have been mainly those connected with the more strictly botanical aspects of the visit but such selection though appropriate to this journal is somewhat invidious and the Director would wish to place on record his deep appreciation of the warmth of his welcome by all with whom he came in contact and the kindness he received from those, far too numerous to mention, who contributed alike to his mental and material welfare.

Dr. W. B. Turrill, Keeper of the Herbarium, has been elected President of the Botany Section, British Association for the Advancement of Science, for 1950.

The following appointments during the year are recorded :—

Appointment as Scientific Officer :—

S. G. Harrison, B.Sc.

Appointment as Assistant (Scientific) :—

Miss Joan Foster.

The Herbarium

There has been a considerable increase in the amount of research carried out in the Herbarium during the past twelve months. In accordance with the arrangement made by the Director with the Colonial Office, in connection with the Flora of Tropical East Africa, Mr. J. B. Gillett and Mr. R. B. Drummond have been appointed as botanists, and Miss D. R. Thompson has been appointed as artist, to assist in the preparation of this work.

The Keeper of the Herbarium and Library and Mr. Milne-Redhead are acting as editors and have prepared a scheme for the format of the Flora which is being tested in the working out of a moderately sized family.

The amount of routine work carried out during the year is indicated in part, by the following figures :

Specimens received 38,879 ; specimens borrowed 7,989 ; specimens sent on loan 4,518 ; specimens distributed as duplicates 5,148 ; sheets mounted 34,681.

Laying in has approximately kept up with the number of sheets mounted.

Visits paid to the Herbarium and Library by botanists numbered 4,184.

The following botanists, amongst others, have carried out research, often for long periods, on the groups or subjects named :

C. H. Andreas (*Alisma*) ; I. H. Burkill (*Dioscorea*) ; E. A. Chenery (aluminium in plants) ; P. H. Davis (Flora of Asia Minor) ; W. P. Fang (Flora of China) ; I. P. Fanning (*Narcissus*) ; E. Hultén (Flora of Alaska) ; G. Jackson (Flora of Nyasaland) ; G. J. Lewis (Flora of S. Africa) ; A. Lourteig (Flora of Argentina) ; F. Markgraf (*Gnetum*) ; F. G. Meyer (*Valeriana*, etc.) ; I. Reichert (Fungi) ; R. A. Silow (*Gossypium*) ; W. T. Stearn (*Lilium*, etc.) ; P. C. Tsoong (Flora of China) ; J. Whittaker (Flora of Iceland).

The scientific staff continue to be indebted to Col. E. Armstrong and Mr. W. C. Worsdell for their assistance in the translation of papers from various foreign languages. Miss M. M. Whiting has continued to give valuable voluntary service in re-arranging material from the Indian sub-continent and Malaysia. Miss S. Wilson has helped greatly to keep the laying-in of the collection of drawings up-to-date. Dr. J. Hutchinson has worked in the Herbarium especially on British plants.

During the year a total of 2,183 enquiries and plant consignments has been dealt with. The higher standard of collecting noted in last year's report has been maintained.

Europe, Orient, and North Africa. Work has continued on E. R. Guest's collections from Iraq and on Mrs. Dickson's collections from Kuwait. Research on desert species of *Heliotropium* and on Cyprus species of *Origanum* promises very interesting results. A detailed investigation of *Vicia monantha* has been made and a revision of *Ricotia* almost completed. Important additions to the collections have been received from Sweden, Holland, Denmark, Asia Minor, Cyprus, Arabia, Persia, and Egypt.

British plants have been presented by J. E. Lousely, C. A. Sinker, T. A. Sprague, the Botanical Society of the British Isles, and many members of the Kew staff.

China and Japan. Many plants from China in cultivation in British gardens have been determined. Some of these determinations necessitated considerable revision. Research has been concentrated on *Lilium*, *Nomocharis*, and *Camellia*.

India. Dr. D. Chatterjee, Assistant for India, returned to Delhi on 11th March 1949. No one has been appointed in his place.

Malaysia. Further special requests for the determination of material, in connection with timber samples, were received from the Conservator of Forests, North Borneo, and, with the exception of the *Dipterocarpaceae*, were dealt with. No further work was done on the Oxford University Expedition's outstanding material from Sarawak, but considerable preliminary study was made of material of *Gonystylus* and *Pentaphragma* received on loan from Buitenzorg, Singapore, Kepong, and Washington, in connection with the Flora Malesiana, and a paper on some of the new species of *Gonystylus* detected has gone to press. The Malaysian material of *Ixora* was kindly rearranged by Miss M. M. Whiting in accordance with Bremekamp's revision.

Tropical Africa. Progress is being made in naming and incorporating the large numbers of specimens which accumulated during the war years, whilst excellent collections which continue to come in are being dealt with as quickly as possible. Particular reference should be made to collections from Sierra Leone (F. C. Deighton and others), Liberia and French Guinea (J. T. Baldwin jr.), Nigeria (R. W. J. Keay), Belgian Congo (R. Germain), Uganda (W. J. Eggeling and J. W. Purseglove), Eritrea, Somaliland, and Kenya (P. R. O. Bally), Kenya (A. Bogdan and E. M. Tweedie), Tanganyika (P. J. Greenway and R. M. Hornby), Nyasaland (P. O. Wiehe), Portuguese East Africa (H. G. Faulkner and G. Pedro), N. Rhodesia (A. W. Cruse), S. Rhodesia (H. Wild), Angola (J. Gossweiler), and Bechuanaland (O. B. Miller). In addition many smaller, but valuable collections have been received from other correspondents and from the National Herbarium, Pretoria. Valuable duplicates in exchange have been received from Brussels, Paris, and Coimbra.

Researches on the groups mentioned in the Review for 1948 (K.B. 1949, 4 : 1949) continue. In addition *Aneilema*, *Zornia*, *Trifolium*, and *Rhus* have been critically investigated. Dr. Bremekamp (Utrecht) has continued his revision of African *Oldenlandia*, and Prof. Suessenguth (Munich) has determined many African *Amarantaceae* for us.

Good progress has been made with the account of L. J. Brass's plants collected on the Vernay Nyasaland Expedition, 1946. Help has also been given to Dr. F. W. Andrews in his revision of the Flora of the Anglo-Egyptian Sudan.

The year's attachment of Mr. B. Verdcourt ended in September, and he proceeded to Amani to take up his duties as Botanist at the East African Agricultural and Forestry Organization.

Other botanists who have been attached to Kew for experience in Herbarium methods are Mr. H. G. Dawkins (Uganda Forestry Department), Mr. J. R. Welch (Tsetse Research Department), Mr. G. Jackson (Agricultural Probationer to the Colonial Office) and Mr. J. G. Andoh (Gold Coast Forestry Department).

Visitors working on tropical African plants included Dr. J. T. Baldwin jr., Dr. F. A. Mendonca, Dr. A. R. Torre, Mr. R. W. J. Keay, Dr. F. W. Andrews, Mr. K. R. Mayer, Dr. A. Katz, and Mr. F. C. Deighton.

South Africa. Valuable consignments of specimens have been received from the National Herbarium of Pretoria, from the Bolus Herbarium, Cape Town, and from private individuals. The compilation of a bibliography of South African botany has been completed by Mr. Bullock and awaits publication. Miss P. Kies has worked sespecially on *Compositae* and *Liliaceae.*

America. The botanist in charge has tried to give priority to work on collections or special consignments from British Guiana and Trinidad. He has worked on the collections of the British Guiana Forest Department, and also named the collection made by the Italian Expedition to British Guiana, about 1930, in response to a request by Prof. Pichi-Sermolli. Several consignments from the Imperial College Herbarium, Trinidad, have been dealt with, and the ms. of Mr. Simmonds's work on monocotyledons for the Flora of Trinidad and Tobago has been revised. A small collection from Venezulian Guiana has also been named. Small consignments from British Honduras and Dominica have also been identified.

So far as time has permitted, progress has been made with the naming of the large and important collections made by Mr. C. Sandeman in Colombia.

An extensive series of cultivated passifloras sent in from Amani by Mr. P. G. Greenway was named for the African Department.

Special work on *Bignoniaceae* :

(a) The mss. of the account for the Flora of Trinidad and Tobago is now in hand, and well on the way to completion.

(b) A large consignment sent from Argentina has been identified.

(c) Small consignments sent from Ecuador and Brazil have been named.

Australasia (including New Zealand, Oceania, and New Guinea). Most of the work consisted in answering queries, but work was continued on naming and incorporating the immense Western Australian herbarium of Dr. A. Morrison. In conjunction with Mr. Fanning a number of cultivated eucalypts from Ireland, the Riviera, and elsewhere were studied. The gatherings made by the Rev. N. E. G. Crutterell in Papua in 1947 and 1948 were named; these contained many high altitude gatherings of especial interest.

Research on Fiji, Solomon Islands, and New Guinea *Ficus* was continued as far as time permitted.

Miss Lewis commenced a critical examination of the Australian Composite genus *Pithocarpa* on which it is hoped to publish a joint paper.

Orchidaceae. Routine naming of specimens from the Gardens and from various geographical areas was carried on actively. These were to a large extent African, among them being collections from French Guiana by R. Schnell, Uganda by W. J. Eggeling and J. W. Purseglove, and S. Rhodesia by F. C. Greatrex.

Research was continued on African orchids, particularly *Habenaria*, *Bonatea*, and various Angraecoid genera.

Glumiflorae. The main work on the group, as in previous years, has been the naming of numerous specimens (+ 3,000), mainly from Tropical Africa. These include valuable collections from Sierra Leone, Liberia, Gold Coast, Nigeria, French Central Africa, Anglo-Egytian Sudan, Abyssinia, Kenya Colony, Nyasaland, Southern Rhodesia, and South Africa. From these or earlier acquisitions many new species have been described or partly investigated, in several instances necessitating a revision of the genus or section of the genus concerned. In particular, detailed studies have been made in the genera *Andropogon*, *Eragrostis*, *Loudetia*, *Tristachya*, *Urelytrum*, and several smaller genera.

Numerous queries from correspondents and visitors to the Herbarium have been dealt with, involving the nomenclature of genera and species, investigation of new species, reference to the literature on the morphology and anatomy of grasses, economic applications, and sources of supply of seeds or plants required for various purposes (cytological research, soil-binding, pasture plants, lawn-grasses, etc.).

Lists of the grasses of the Gold Coast and Anglo-Egyptian Sudan have been revised and the nomenclature brought up-to-date, whilst several papers dealing with various aspects of the study of the Gramineae have been checked for their authors (Grasses of Barbados, Cytology of African grasses, etc.).

Instruction on the classification and methods of identification of grasses have been given to botanists and agricultural officers proceeding to Borneo, Nyasaland, Tanganyika, and Uganda.

Research in the *Cyperaceae* has been mainly concentrated on a revision of Malaysian *Carex*, now on the eve of publication, involving this year the examination of 1570 sheets from the Herbarium of Buitenzorg and 588 sheets from Leiden.

The genus *Uncinia*, and the remarkable *Schoenoxiphium kobresioideum* Kukenth., in Malaysia, have been investigated, as part of the preparation of the *Cariceae* for the Flora Malesiana.

A new genus of the *Scirpeae* was published.

Vascular Cryptogams. Much time has been devoted to determination of living plants grown in the Gardens and material from dried collections from various countries. Research has been concentrated on African, and especially Tropical East African, genera.

Algae. Various collections have been determined and the material laid in. Research has been mainly on specimens from the Gold Coast.

Fungi. Routine work during the year has included considerable help with identification given to other workers either conducting surveys or investigating special groups. In this way the Herbarium has been enriched by the acquisition of many unusual species, as recently, for instance,

by various hypogeal fungi which are very rarely collected. Assistance has also been given to other mycologists and lichenologists by means of loans of type material.

The assistant mycologist has continued his work on the inoperculate *Discomycetes*, but this was interrupted when he left in early September to spend about four months collecting Agarics in Trinidad. The senior mycologist has continued her investigations on the lower *Basidiomycetes*, and completed and sent to press an account of the Rust Fungi of Uganda.

Mr. P. K. C. Austwick, holding a Research Studentship from the Agricultural Research Council, started work in October on the anatomy of British *Polyporaceae*.

Fumigation Chamber. This was used on twenty-two occasions. Mounted material fumigated included the genus *Rhododendron* (all material), *Sorghum*, *Berberis*, *Nymphaea*, *Papaver*, African *Capparis*, and several genera of *Compositae*. The Herbarium was fumigated with D.D.T. smoke during the summer with the object of killing all adult flying beetles.

Experimental Ground. A considerable rearrangement of the beds has been undertaken particularly with a view to providing for the species collection of *Dianthus*, now comprising some fifty stocks which is specially financed by a grant from the Ministry. Specimens of a large number of species were collected for the herbarium in both flowering and fruiting condition, and studies of *Viola*, *Silene*, *Cerastium*, *Vicia*, *Dipsacus*, and *Centaurea* have been continued by various members of the staff.

Spirit Collection. Many hundred bottles were added to this during the year, particularly from Africa, where the collections are now reaching the useful stage of representation. Especially valuable collections of species of *Utricularia* were received from various sources.

Collection of portraits. The collection of portraits of botanists, hitherto mounted on large cards and contained in large portfolios, has now been transferred to filing cabinets. All those portraits which do not exceed 10″ × 8″ have been transferred to special stiffened envelopes which are arranged vertically in alphabetical order of names. The few portraits which exceed 10″ × 8″ in size remain in the original portfolios.

Index Kewensis. The compilation of the next supplement (1941–50 inclusive) has proceeded slowly owing to reduction and change in staff. The independent works received at Kew have been examined and good headway has been made with the periodicals. Little work has so far been done at the British Museum (Nat. Hist.). The amount of literature from which extraction has to be made has greatly increased in recent years, but the number of new names found is relatively far less than formerly. The number of entries in the new supplement, including genus cards, is estimated as roughly 30,000.

Botanical Magazine. Volume **166** (N.S. tt. 45 to 88), edited at Kew for the Royal Horticultural Society, was published in four parts. Reproduction of the coloured plates was by a photogravure method and the standard of the text has been maintained, if not enhanced. Of the 44 articles, 41 have been contributed by members of the Kew staff. Many of them have involved considerable original investigations. The Royal Horticultural Society has presented the originals of the plates and text figures to the Kew Herbarium.

Students' Exhibits. On the 6th and 7th May 1949, special exhibits were arranged for students in the three wings of the Herbarium. Members of the staff cooperated in preparing series of specimens (living and dried), maps, diagrams, books, etc., in illustration of the research work carried out at Kew. About 300 students and teachers visited the exhibition during the two days.

The Library

With the provision of a special grant for the purpose, progress has been made in binding arrears which accumulated during the war years and many volumes needing attention have been bound or rebound.

Numerous enquiries of a bibliographical and biographical nature have been dealt with by the Library staff during the year. Our entries for the new edition of the World List of Scientific Periodicals have been revised and a list of new periodicals taken at Kew since the publication of the last edition has been sent to the editors.

As in former years books and other publications have been lent to other Government Departments and Agricultural Bureaux. Loans to workers on *Diatomaceae* have been continued from the Bentham-Moxon collection of books on this group of plants.

Many additions to the Library have been received either as purchases, exchanges, or presentations during 1949. A number of publications have been sent from their publishers for review while a number of books have been generously presented by the authors, by members of the staff, and others. Our collection of reprints has been enriched by copies of many botanical papers kindly sent by the authors.

We are again indebted to the Royal Horticultural Society, the Empire Cotton Growing Corporation, the New York Botanical Garden, the Carnegie Institution of Washington, the Commonwealth Agricultural Bureaux, Departments of Botany, Agriculture, and Forestry, Societies and Institutions both at home and abroad for publications received during the year.

The Ordnance Survey and the War Office have kindly continued to send us maps, thus making valuable contributions to our collections.

The Museums

A total of over a thousand enquiries have been dealt with by the Department during the year. These have covered a wide range of economic plants and plant products.

A notable feature has been the number of enquiries relating to tanning materials. Difficulties over supplies of quebracho from the Argentine and currency questions have stimulated interest in other vegetable tanning materials. One of the less known uses of tanning materials is in oil drilling, to reduce the viscosity of the drill mud without reducing the specific gravity. Quebracho extract has been much used in this connection. Information on other vegetable tanning materials has been supplied to a well known oil firm interested in this subject.

A number of the enquiries received have been on fibres, particularly on jute substitute fibres and on " green " and " white " Ramie. The fibre

of *Clappertonia ficifolia* Decne (syn. *Honckenya ficifolia* Willd.) which is a common plant in many parts of West Africa is attracting attention in some quarters with a view to possible development commercially. The plant is of rapid growth, given the right conditions and is capable of yielding high quality fibre.

Other enquiries dealt with have included :—advice to an engineering firm contemplating producing a new type of tea dryer and requiring leaves of a kind suitable for trial purposes and available in quantity locally : identification of carbonized and fossilized seeds and fruits from a neolithic village site in the Sudan : identification of " sacapira " beans from Brazil (*Pterodon* sp.) said to be efficacious in fever : information on " Tonkin cane " (*Arundinaria amabilis* McClure) and its occurrence and exploitation in southern China : information on the genus *Eugenia* with a view to selecting species closely allied to the Clove tree likely to be suitable for grafting in connection with the work now in progress on disease control with this crop : information on Indian Artemisias known to be rich in santonin : the cultivation of Indian Khus root (*Saussurea lappa* Clarke) : the use of " tropical kudzu " (*Pueraria phaseoloides* Bth.), and the cultivation of angelica and of *Ammi visnaga* in Commonwealth countries : the identification of nut kernels said to have been used in South Africa in confectionery and to have caused vomitting (*Ricinodendron*, probably *R. rautanenii* Schinz).

Interest in medicinal plants continued and information on the cultivation of purgative drugs, mints and other *materia medica* has been supplied to correspondents in South Africa, Australia and other parts of the Commonwealth. Much public curiosity has been aroused in *Strophanthus sarmentosus* A.P.DC. as a source of cortisone, and a number of samples of seeds of *Strophanthus* and other Apocynaceae and Asclepiadaceae have been received for identification. One consignment offered for sale consisted of seeds of a *Holarrhena* sp., and a description of these with a warning against accepting without close scrutiny any seeds purporting to be *S. sarmentosus* was published in the pharmaceutical press.

The unusually prolonged drought had its repercussions on the work of the Museums. When the limes, *Tilia* spp., came into bloom in June their blossoms were soon dried up and the usual nectar flow was cut short. At the same time, conditions favourable to the development of aphids resulted in a heavy deposition of honey-dew on the leaves of limes and other trees. Public interest was aroused in the nature of this sticky excretion and the reason for the blackening of pavements below lime trees. At the end of July when beekeepers were extracting their honey, enquiries as to the cause of dark or nearly black honeys were received. Honeys examined microscopically gave evidence of the presence of honeydew, but it was found that the dark colour of samples from the London area was due mainly to the presence of soot particles and only to a very minor extent to the spores of sooty moulds. Although such honeys are inferior in flavour and colour, they nevertheless appear to be quite wholesome.

Later in the season the effects of the drought were manifested in enquiries concerning subsidences in buildings resulting in cracked walls.

In several instances, poplars and other large trees planted too near to buildings were responsible by causing a shrinkage of clay soils under parts of the buildings adjacent to the trees. An increase in the number of animals poisoned, or suspected of having been poisoned, by browsing on shrubs may be attributed to shortage of green fodder caused by the drought. The yew, *Taxus baccata* L., was responsible for some deaths and circumstantial evidence pointed to the snowberry, *Symphoricarpus albus* Blake, as the cause of another. Evidence of poisoning by the snowberry is inadequate and it is being investigated further.

A constant stream of specimens of conifers and other hardy trees and shrubs was received for identification. During the year, the greater part of the living collections of conifers at Bedgebury has been examined and corrections made in the identifications where necessary. Material of forms not represented in the Arboretum Herbarium was gathered and added to the collection.

A large number of specimens showing interesting examples of fasciation were received during the summer months from various parts of the British Isles. It is probable that the unusual summer conditions favoured the development of fasciated tissue in many species. A special exhibit of interesting examples of fasciation was arranged in one of the museums.

Special exhibits were also arranged in June and July in connection with "Colonial Month" organised by the Colonial Office. This included an exhibit of floras and other botanical works on the Crown Colonies which have been prepared at Kew.

Among the specimens of special interest donated during the year were the following—wood of *Ulmus plotii* Druce from the type tree at Banbury, Oxfordshire, blown down in a gale about 1943 : a portion of the trunk of the Chilean species *Azara microphylla* Hook. f. from a tree of apparently exceptional size for one grown in this country. (The latter was received from Sir Stephen Middleton, Belsey Castle, Newcastle-upon-Tyne, who stated that his grounds contained a number of unusually large specimens of many of the less common trees and shrubs). A fine Wedgewood plaque of Sir William Hooker, presented by his great grandson, Lt. Col. E. E. P. Hooker of Penpont, Brecon, has been placed (temporarily) in No. 1 Museum.

A study of certain aspects of the early history of Kew has been undertaken by one member of the staff in co-operation with an historian who has paid several visits to Kew and also carried out research in Continental countries. Certain interesting points which do not appear to have been recorded hitherto have been brought to light. It is expected an account of these will be published jointly in the near future.

A rearrangement of the cases has been effected in No. 3 Museum, and many of the specimens may now be seen to better advantage. A good deal of relabelling has also been done in this Museum.

In No. 1 Museum the installation of a new boiler, necessitating the rebuilding of the boiler house, has resulted in greatly improved heating throughout the building, including the top floor, where previously the heating was very inadequate in cold weather.

Staff

Mr. S. G. Harrison, B.Sc., formerly an Indian Army Officer and at one time in the Andamans, was appointed temporary scientific Officer in the Museum Department on the 22nd August, having had his degree course at Leeds University interrupted by the war.

Jodrell Laboratory

Larger windows have been put in the main room on the north side of the building to provide better light for microscopical and dissecting work. Much needed improvements in the heating facilities in the same room have also been provided by H.M. Ministry of Works. These alterations have made it possible for the Keeper to occupy the main north room, where interviews and discussions with visitors can now be held in less cramped conditions than those prevailing in his former office. The Keeper's former room is now used to house the reference collection of microscope slides, and is also available for the use of visiting botanists. The whole building has been completely redecorated both inside and out, an operation that had been postponed for a very long time on account of the war.

Rather more than eighty timber samples have been examined microscopically and identified during the year. Many of these were unfamiliar types that seldom occur in commerce, and, in consequence, their identification was frequently rather difficult. A few samples could not be identified at all owing to their not being represented in our reference collection.

About ninety-three samples of charcoals from archaeological excavations have also been identified at the request of archaeological experts. This material, much of which was very difficult to deal with, was excavated in various countries including Great Britain, France and Cyrenaica.

Numerous other miscellaneous samples have been examined with a view to establishing their botanical identity. These included material from the stomach of a valuable pony which had died unexpectedly. The stomach contents were shown to consist largely of the stems and leaves of *Robinia pseudacacia* which are known to be toxic to horses. Several samples of roots that were undermining the foundations of buildings, or filling drains, were also identified, chiefly at the request of architects.

Considerable time was devoted to correcting the proofs of the reference book entitled " Anatomy of the Dicotyledons ". In their final form the two volumes of this book will consist of exactly 1500 pages, together with an Introduction of 64 pages. Page proofs of the entire work, including the Bibliography and Index, have been corrected, and revised page proofs of about 1400 pages have also been dealt with. Proof reading has been slower and more exacting than was at one time anticipated, but the continued close collaboration of Dr. Chalk of the Imperial Forestry Institute, Oxford, and considerable assistance from Miss E. M. Slatter have enabled the work to proceed steadily throughout the year. Mr. E. Nelmes completed the index under the supervision of the authors, and also assisted to correct the proofs of this part of the book. In the opinion of the authorities at the Clarendon Press the printing of the

book will have been completed by the end of January 1950. In collaboration with the publishers, arrangements have been made for reviewing and advertising the book.

Miss E. M. Slatter completed the preparation of a card index to the literature dealing with the anatomy of the Monocotyledons, on which it is proposed to write a book which will be a sequel to " Anatomy of the Dicotyledons ". Considerable correspondence concerning the sequel has been conducted with Dr. F. J. Meyer of Brunswick, who was engaged in preparing a German book of reference on similar lines. In view of the work now being undertaken at Kew, and because of the economic difficulties by which his publishers are confronted, Dr. Meyer has now decided not to continue with his work and has offered to assist with the book to be prepared at Kew.

The Keeper made a special investigation of the anatomy of the *Dioncophyllaceae*, and has written an account of these researches for publication. The article is intended to accompany one on the taxonomy of the family by Mr. H. K. Airy-Shaw. The Keeper also examined, and has drawn up a description of, the anatomy of a newly discovered plant of great taxonomic interest, collected in the Cameroons by Mr. J. P. M. Brenan.

Mr. F. Richardson has continued to make microscope slides of representatives of the Monocotyledons and of numerous timbers, all of which have been incorporated in the reference collection. His increasing ability to assist in identifying the numerous samples received at the laboratory has enabled the Keeper to devote more time to research than would otherwise have been possible. Mr. Richardson has also experimented with the use of polyvinyl alcohol as a mounting medium for microscope slides, and, in collaboration with the Keeper, has prepared an account of these investigations for publication.

We are greatly indebted to Dr. Chalk, of the Imperial Forestry Institute, Oxford, for the loan of a set of punched index cards on which data (mostly original) are recorded whereby the timbers of some 4,000 species can be identified. This enabled Miss E. M. Slatter to prepare a duplicate set of the cards which will serve as the nucleus of a collection of our own. The cards have already proved useful in facilitating the identification of unfamiliar timbers.

Miss Slatter continued her work on raising irises from excised embryos cultivated on nutrient agar under aseptic conditions. An account of this work is now ready for publication.

The British Pharmaceutical Codex 1949 was published towards the end of the year. In it acknowledgment is made of assistance in the preparation and revision of monographs on vegetable drugs given by the Keeper whilst serving on the pharmacognosy sub-committee for more than ten years.

Professor I. Manton and Dr. E. K. Janaki Amal have made use of the laboratory from time to time when fixing material for cytological examination. Dr. T. E. Wallis, Dr. Fairbairn, and a few of their colleagues and students at the Pharmaceutical Society have visited the laboratory periodically for consultations concerning the microscopical structure of vegetable drugs.

The Gardens

The year 1949 was exceptional because of the record amount of sunshine during the summer months and this, combined with long periods of drought, made the maintenance of the collections out of doors a very difficult task. The total rainfall for the year was about 22 1/2 ins. but as over 10 ins. of this fell in the last three months of the year, the shortage throughout the rest of the season can readily be appreciated. Several young trees transplanted two seasons ago were scorched by the sun and never recovered, and there were many fatalities among the older trees.

Once again requests for plant identifications and for technical advice in connection with plant maintenance were very numerous, and close on six thousand items of this kind were dealt with by the Curator's office staff during the year.

Arboretum

Serious losses continue amongst the older trees, and more particularly amongst the Beeches. Eleven large specimens have had to be removed because of their dangerous condition, these comprising seven Beech, one Sweet Chestnut, one large Cedar and two Pines. In addition, a number of Elms have also had to be removed because of attack by Dutch Elm Disease. In autumn a very large Lime tree near Brentford Gate was blown down and in falling badly damaged a number of young birches which subsequently had to be removed.

The prolonged drought during the summer months was responsible for a large number of branches being shed from trees, particularly from Beeches. In order to obviate danger to the general public seats had to be moved away from large specimen trees into the open. As yet it is too early to assess the effects of the exceptionally dry season on both trees and shrubs. A large number of trees were defoliated by early September, whilst the foliage on other trees has remained until December. It was anticipated that the display of autumn colour would be well above the average but this was not so, and only a few, notably the Japanese Cherries, were above normal.

The display of flowering trees and shrubs was again good, though the dry atmosphere tended to cut short the period of blossoming and did not favour the later flowering shrubs. In early spring, Rhododendrons, Magnolias, Malus and Prunus flowered freely and if anything the Japanese Cherries were better than usual. During the season several rare species flowered including *Paulownia tomentosa*, *Cladrastis sinensis*, *Rhododendron macrocarpum* and *Elliottia racemosa*. It was anticipated that seed crops would be well above the average and though this proved to be so with most genera, there was a definite shortage of fruits on many of the Rosaceae, including Crataegus, Malus and Cotoneaster.

The chief constructional operation carried out during the year was the building of a Clematis wall and mound near to the Berberis Dell. A certain amount of contouring, which necessitated the use of a bulldozer was first carried out, after which some 120 tons of limestone rock were used in building the wall. The dry weather in February and March facilitated operations, and many of the old specimens of Clematis were successfully transplanted in new positions. It is anticipated that by the

spring of 1950 the whole of the Clematis collection, with a few exceptions, will have been planted on this site, thus doing away with the unsightly and unsatisfactory pole supports that were formerly used.

The general overhaul of the Bamboo Garden which was carried out during the spring enabled the species of *Arundinaria*, *Phyllostachys* and *Bambusa*, obtained from the United States Department of Agriculture during 1947, to be added to the collection. The Vitis and Ampelopsis collection on the pergola surrounding the Tea Pavilion also received attention and the nomenclature was checked and corrected where necessary. The display of fruit on a number of the vines has been exceptionally good and *Vitis brevipedunculata* var. *Maximowiczii* with its pale blue fruits was outstanding. Opportunity was also taken to replant the Cytisus collection, where a number of species had become badly overgrown. Several of the beds were replanted with young stock specially raised for this purpose.

A number of young *Metasequoia glyptostroboides* have been planted out in selected positions and in spite of the dry season have made satisfactory growth. The two trees planted out in September 1948 in the nursery have grown rapidly and are now over 5 ft. high and appear perfectly hardy. Further consignments of seed received from the Arnold Arboretum were sown, and 100 seedlings have been sent to Bedgebury Pinetum for trial there. Plants raised from cuttings in September have also grown freely and cannot be distinguished from seedling plants by their growth characters. Specimens of this species have been distributed to a number of selected gardens to test its reaction to various soils and climatic conditions.

The area of land devoted to vegetables was this year reduced, and a portion which has been under vegetables for some ten years was resown with grass seed and an excellent sward obtained. Experiments have been carried out with the use of coffee residue for mulching purposes and in the majority of tests the results have been beneficial.

A number of new introductions and additions were received during the year and noteworthy among them were *Nothofagus betuloides*, *Stuartia ovata*, *Ehretia microphylla*, *Magnolia glauca*, *Populus vancouverensis*, *Fraxinus Raywoodii* and *Liquidambar fosterii*. A large consignment of seeds collected by Kingdon Ward was received from the New York Botanic Garden and also one from the British Museum of various seeds collected by Captain Sherriff and Mr. Ludlow.

Decorative Department

Without question the most noteworthy of the spring bedding was the display of Darwin Tulips on the Palm House front. The all-round uniformity and excellence of bloom well repaid the work carried out the previous autumn when many beds were resoiled. Along the Broad Walk many beds of tulips were badly effected by Fire Disease. Wallflowers usually give a poor display at Kew but owing to the very mild winter they were extremely good this year.

The hot dry summer months favoured the display of Pelargoniums, and they continued to flower from the last week in May until well into October. The introduction of tuberous Begonias in beds near the Lake

created much interest amongst the visitors, and these beds were possibly the most colourful of all in the bedding schemes. The bedding Dahlias along the Broad Walk stood up very well to the dry conditions though before the end of the summer the prolonged drought tended to reduce their flowering considerably. In the Rose Garden the flowering was the worst for many years and some of the older beds suffered so drastically from the hot dry atmospheric conditions that much replenishment will be necessary.

Various structural alterations were carried out in the glasshouses in the department, the most important being the erection of new concrete centre and side stages in House 21. The installation of a new concrete sill in House 19 greatly facilitated the ventilation of the house as previous to this the side ventilators could not be opened. In the Conservatory seasonal displays have been well maintained and decorative plants such as Cyclamen, Primulas, Cinerarias, Calceolarias, Begonias and many others have flowered to advantage no doubt because of the additional amount of sunshine. This latter factor was probably responsible for the shortness of the flowering season of the Chrysanthemums as very few varieties continued to bloom well into December. The " Charm " type of Chrysanthemum formed a special feature in the display.

The fruit and vegetable demonstration plots were again maintained by the department and on the retirement of Miss J. Sharps, she was succeeded by Miss R. Periam who acted as demonstrator to great advantage. During the year, owing to disease, the old stocks of Red and Black Currants were discarded and new stocks of these, as well as Gooseberries and Strawberries were introduced in early spring.

Tropical Department—Palm House

A considerable amount of work has been done amongst the Cycad collection and also amongst the Palms, where many of the large specimens which had become overgrown were retubbed during the year. Female cones were produced on *Cycas circinalis*, and these, when fully mature, will be sent to scientific institutions. Interior repainting necessitated a considerable upheaval at the southern end of the house and despite the use of tubular scaffolding a certain amount of damage was done to plant material.

T. Range

During the year a great number of interesting Orchids were added to the collections, many species not having been represented in the collections before. The condition of the plants con inues to improve and to justify the policy of always having permanent men in charge of the collections. In the narrow borders outside the orchid House and facing due south, the bulbous plants such as *Nerine Bowdenii*, *Amaryllis Belladonna* and *Amaryllis Belladonna* var. " Hathor " flowered profusely. Flowering material of the latter plant was shown at the Royal Horticultural Society's Show on September 6th 1949 and received a First Class Certificate. The *Victoria Regia* this year grew remarkably well and benefited from the provision of wire screens to both north and south sides of the tank, which gave added protection to the leaves and also reduced considerably the losses in goldfish.

Ferneries

There is no doubt that the standard of the collections is today greatly improved due, no doubt, to the many fine additions made of recent years and to some extent to the permanency of supervision. Many plants have been received during the year particularly from New Zealand, U.S.A. and the Azores and most constitute valuable additions.

House No. 5

Interior painting which has not been carried out for many years was undertaken in the northern end of the house and the opportunity was utilised of thoroughly overhauling and rearranging the collections of Aloes, Euphorbias, Gasterias, etc. Many of the large plants were retubbed or repotted and the general appearance of this end of the house was greatly improved. Plants of interest that have flowered during the year were *Agave fourcroydes*, *A. ellemeetiana* and *A. filifera*.

Tropical Pits

A good deal of work during the year in this section dealt with economic plants, and particularly Groundnuts (Arachis species). The original seeds were received from the Overseas Food Corporation and after having been grown on, were propagated from cuttings and the resultant plants eventually sent out to Africa by air. A large consignment of seed of Arachis species from Brazil was sown, and the plants will probably be ready for despatch in early spring of 1950. Special stocks of *Hevea brasiliensis* received from Malaya have been grown on from seed, and it is hoped next season to be able to bud these with high yielding varieties. Early in the year Musa stools were received from Amani, Dar-es-Salaam, Hong Kong and Zanzibar and many young plants have been propagated from this stock. These are at the present time being grown on ready for despatch next year to the Imperial College of Tropical Agriculture, Trinidad.

The boilers in the large stoke-hole in the Melon Yard were dismantled, overhauled and reassembled, and in order to improve the draught on the boilers, a complete new back flue was introduced and a new chimney-stack built. During this operation it was found necessary to renew the 6 in. main which runs from the boiler house through the tropical potting shed.

Temperate Department

During the course of the year every effort has been made to increase and to keep in good condition the large and representative collection of tress and shrubs which have been obtained from the north and south temperate zones of the world. The main collections are those from Australia, South Africa, New Zealand, Temperate North and South America, Northern India and such-like places, and these plants generally thrive in a temperature just free from frost and rising to 70–80°F. during the summer period. There is a great variation in soil requirements for these plants, and because of this considerable knowledge and experience is necessary to grow them successfully.

In the war period considerable damage was done to the whole of the Temperate House structure and despite large sums of money spent on re-glazing and re-painting, the whole building leaks badly every time

there is rain. The constant drip from the roof continues to cause serious losses, especially in the South African and Australian collections, and this will continue until this structural defect is remedied. Many plants raised from seed sent over from Australia in 1941, 1942 and 1943 and which had attained a height of 5 and 6 ft, have been lost because of this excess moisture both at the root and in the air.

The painting of the Temperate House, which had commenced in the autumn of 1948 was completed towards the end of the year. The inevitable damage which accompanies such an operation was, despite the use of tubular scaffolding, widespread and serious. Pots of paint were dropped into the crowns of palms and, on one occasion, one of the painters' mates was discovered wiping paint off a plant by means of a rag dipped in kerosine oil.

In early spring there was a fine display of flowering shrubs which had been forced and such plants as Forsythias, Deutzias, Azaleas, various Prunus and special and hybrids of Malus, made a long and lasting display. The Acacias flowered freely from January until May and the large specimen plants of Luculia pinceana and L. gratissima flowered even more freely than usual. The scent from these two trees is a great delight in late winter.

The Java Rhododendrons planted out in the border in the south section of the Temperate House have picked up remarkably well in recent years. They are very fastidious and difficult plants to grow, and the Kew collection, many of which have now attained a height of 7 or 8 ft., can be regarded as the best in Great Britain.

Another feature of the display in the Temperate House is the fine collection of Camellias which have been collected together from all parts of the world. The original plant of *Camellia reticulata* which is now about one hundred years old is still in good health and flowers profusely each spring, whilst many of the forms of *Camellia sasanqua* are worthy of much more attention than they have yet received. The tea plant, *Camellia theifera* and a closely allied and new species, *C. taliensis*, both flowered freely during late autumn, whilst the rose coloured *Camellia saluenensis* continues to flower in both November and December.

Alpine and Herbaceous Department

The very hot dry summer period proved too much for many of the moisture loving plants and several of the Primulas and Meconopsis failed to survive the dry conditions, despite continual watering which was carried out on most days in the Rock Garden. Some plants, of course, appreciated these conditions, and because of them flowered much more profusely than they normally do. Many of the annuals and biennials behaved in this way, though the flowering period of most of these plants was very much shortened.

In the Rock Garden the reconstruction of that section devoted to sandstone formation, was continued and possibly another winter's work will be necessary before this revision is complete. The Sussex sandstone, which is purchased from West Hoathly, weathers remarkably quickly and consequently operations of this kind are carried on without a great deal of disfigurement. At the southern end of the garden many of

the soil pockets in the limestone area were taken out and resoiled. The opportunity was taken, at the same time, of rebuilding several small sections, though this work cannot be completed properly before the sandstone section is dealt with.

In the Iris Garden the majority of the beds were replanted and here and there certain varieties were moved with the object of improving the colour scheme.

For some years now it has been very difficult to carry out the whole of the propagation necessary in the very confined space available within the Alpine Yard. To increase the amount of room available, some of the old frames which were beyond repair have been discarded and several new wooden span frames of a new design were erected in their place. Alterations to further frames and greenhouses are contemplated, and some two or three years may elapse before the desired standard of efficiency is attained.

Amongst the many interesting collections of seeds and plants received by the department during the year were the following :—A collection of Narcissus species, natives of Gibraltar, were received from Mr. G. Roberts; a collection of seeds, native of Morocco, from Monsieur J. Gattefosse ; a collection of hardy North American grasses from Dr. Dare of Ottawa ; a large collection of seeds from Spain collected by Messrs. Heywood and Davis ; a collection of seeds from Turkey sent in by Mr. P. H. Davis ; from the British Museum two collections of seeds, one of seeds collected by Mr. Polunin in Nepal and the other consisted of bulbs and other tuberous rooted plants collected by Messrs. Ludlow and Sherriff. In addition to these outstanding collections, valuable help was received in the gift of both plants and seeds from the Botanic Gardens of Cambridge, Glasnevin, Oxford and Edinburgh and from many other such centres in different parts of the world.

During the year some 5,984 packets of seed were sent out to other establishments, making a grand total, with the Arboretum department, of 13,178, which represents an increase of well over 3,000 packets on previous figures.

In addition to the collections already referred to, some 690 contributions of plants, bulbs, seeds, etc., were received by exchange. It is of course obvious that owing to the magnitude of the Kew collections, we have far more to offer which other scientific institutions do not possess than they have to offer us, but for this very reason the material we receive though less in quantity, often consists of species which are rare or difficult to obtain.

Economic Botanist

Sir Geoffrey Evans continued to act as Economic Botanist on a part-time basis. Mention was made in last year's report of the renewed interest that is being shown by different colonies in the interchange and import of certain tropical plants of economic importance.

Research stations for certain crops of export value, have now been established in different colonies, each of which is engaged on plant

breeding work, with a view to the introduction of higher yielding, better quality and disease resisting varieties. This particularly applies to cacao since the main producing areas in West Africa and the West Indies are now menaced by virus diseases in the former, and by Witches' Broom in the Caribbean.

To meet the situation, it is intended to develop cocoa production in other parts of the world where conditions appear to be suitable and the best planting material avaulable from the Research Stations in Trinidad and the Gold Coast will be utilised to start these new plantations. Attempts are also being made to improve rubber and banana production by similar means.

The chief danger is the spread of disease from one region to another, and to avoid this Kew has been asked to supervise an intermediate quarantine station where introductions can be grown under observation before transfer to their ultimate destination. During the year meetings were held with Colonial Officials and others interested in the project, and it has now been decided to erect a plant quarantine greenhouse in the Melon Yard, as soon as possible. The necessary funds have been provided from the Colonial Development and Welfare Organisation for capital and recurring expenditure and it is hoped that work on construction will proceed without delay. This house will be used in the first place for cocoa introduction, but other plants may also be grown such as rubber, bananas and others as occasion demands.

Sir Geoffrey continued as Chairman of the National Pinetum (Bedgebury) Committee and considerable progress was made during the year in bringing up to date the planting programme, which had been in abeyance, during the war, in overhauling the labelling and in laying down a definite programme for the future.

He continued to serve as a member of the Colonial Advisory Council for Agriculture, Forestry and Animal Health, and also on the other committees mentioned in last year's report. In addition he was asked to become a member of the Colonial Forestry Commission and in view of the decision to develop the forest resource of British Guiana on the lines indicated in the Report of the British Guiana and British Honduras Settlement Commission, of which he had been Chairman, he accepted.

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ROYAL BOTANIC GARDENS, KEW
LIST OF STAFFS

31st December, 1949

Director

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A NEW RUST FROM AUSTRALIA.

R. W. G. Dennis.

Puccinia calogynes *Dennis*, sp. nov., aecidiis amphigenis, sparsis vel aggregatis, 250 μ diam., cupulatis, albidis, margine recurvato, inciso ; cellulis peridii firme conjunctis, rhomboideis, 25–30 × 10–15 μ, pariete exteriore striato, 3–4 μ crasso ; aecidiosporis polygonis vel subglobosis, subtiliter verruculosis, dilute aurantiacis, 12–13 × 10–12 μ. Soris teleutosporiferis amphigenis vel caulicolis, sparsis saepius circa æcidia sitis, minutis, rotundatis vel elongatis, atris ; teleutosporis clavatis vel oblongo-clavatis, apice rotundatis vel acutiusculis, incrassatis usque 6 μ, medio plus minusve constrictis, basi attenuatis, lavibus, brunneis, 35–46 × 17–20 μ, pedicello hyalino, persistente. Hab. in foliis vivis et in caulibus *Calogynes berardianae*, Australiae Occid. Typus : Wongan Hills, *A. Morrison* 13207, 7. x 1903.

From most species of *Puccinia* previously described on Goodeniaceae *P. calogynes* differs in its smaller teleuto and æcidiospores. From *P. gilgiana* P. Henn. it differs in the host genus and in the apparent absence of uredospores. These differences are brought out in the following table.

Species	*Teleutospores*	*Aecidiospores*	*Uredosori*	*Host genus*
P. dampierae Syd.	48–66 × 16–26 μ	15–19 × 13–14 μ	Absent	*Dampiera*
P. brunnoniae McAlp.	45–60 × 9–10 μ	17–21 × 15–16 μ	Absent	*Brunonia*
P. saccordoi Ludw.	40–66 × 17–25 μ	14–17 × 13–14 μ	Absent	*Goodenia* & *Velleia*
P. gilgiana P. Henn.	30–45 × 16–22 μ	15–20 μ	Present	*Leschenaultia*
P. calogynes	35–46 × 17–20 μ	12–13 × 10–12 μ	Absent	*Calogyne*

CLASSIFICATION OF THE BANANAS.

By E. E. Cheesman.

Imperial College of Tropical Agriculture, Trinidad, B.W.I.

III. Critical Notes on Species.

o. Musa lolodensis *Cheesman* sp. nov.—*Planta alta, stolonifera, foliis utrinque viridis, inflorescentia pendula, bracteis fusco-luteis nitentibus convolutis multifloris, floribus aurantiacis, fructibus in maturitate dehiscentibus, seminibus rotundatis angulatis depressis.*

This very interesting species was received as seed in July 1940 from Dr. David Fairchild, who has also kindly furnished me with notes on the original collection. The seed had been collected in June by Dr. Fairchild and Mr. Hugh M. Curran in North Halmaheira, N.E.I. and the collection is Fairchild Tropical Garden Expedition Accession No. 388.

The plant has the stature and general habit common among edible bananas, with the rather shining green leaves and pseudostem of *M. textilis*. It is quite distinct from that species by its brownish-yellow convolute bracts, the colour of its flowers, and its entirely different fruit. It has, however, 10 pairs of chromosomes (K. S. Dodds, unpublished) and on that fact and the shape of its seeds is referable to the same section as *M. textilis*, viz. §*Australimusa*.

The species presents several features of interest. In its female flowers it has organs which from their position must be regarded as staminodes, but which end in sticky knobs exactly like reduced stigmas. The ripe fruit dehisces, and that is a habit known to me elsewhere in *Musa* only in *M. velutina* Wendl. & Drude, a species of the section *Rhodochlamys* far removed in other characters from *M. lolodensis*. The pulp surrounding the seeds is a deep yellow colour as in *M. fehi* Bert. ex Vieill. with which species *M. lolodensis* agrees in chromosome number and probably has fairly close affinities.

Individual plants of the half-dozen growing in our plots show some small differences. A noteworthy one is that on some individuals the peduncle and rachis are glabrous whilst on others they are distinctly pubescent. As pubescence of the peduncle has sometimes been considered a useful character in identification of species, it is rather important to observe that in this species at least it is not diagnostic.

A fuller description in English is :

Plant stooling freely ; pseudostems up to 4 metres or more in height, 20 cm. in diameter at base, upper parts of leaf sheaths rather bright green, shiny, devoid of wax, developing brown-black blotches varying with age and exposure. Leaf blades up to 3 m. long, 60 cm. wide, truncate at apex, unequally rounded at base, one side of the lamina a little shorter than the other, lightly glaucous beneath ; midribs paler than the lamina ; petioles 30–50 cm. long, scarcely margined above but strongly concave, their edges nearly meeting over the adaxial channel, margined towards the base, the margins closely appressed to the pseudostem and not becoming scarious.

Inflorescence pendulous in well grown examples, or at least semi-pendulous, its peduncle and rachis either glabrous or pubescent ; sterile bract about 60 cm. long, its upper quarter leaflike ; first fertile bract 45 cm. long, greenish without, dark brown within, its extreme tip leaflike ; basal flowers female, the number of female " hands " varying up to about 8, upper flowers male.

Female flowers 7–14 per bract, in two rows ; ovary 5 cm. long, bright green, glabrous, or pubescent on the pedicel only ; compound tepal 4·5 cm. long, cream, its lobes orange yellow, the lateral lobes broadly ovate, 4–5 mm. long, with a filiform dorsal appendage 2 mm. long, centre lobe narrower, also appendaged, accessory teeth 3 mm. long, of a paler yellow ; free tepal oval, 4 cm. long, 2·3 cm. wide, white, corrugate at the tip behind a 2–4 mm. apicula ; staminodes 5, varying from 1·5 cm. to 4 cm. long, the longer ones ending in viscous stigma-like knobs.

Male bud in advanced blooming broadly ovoid, the bracts convolute at the tip or only very slightly imbricate ; bracts yellow to pinkish brown outside, often with a greenish cast, quite without wax and shining with a polished appearance, inside darker, dull pinkish brown, and longitudinally striate.

Male flowers about 14 per bract in two rows, 5–6 cm. long overall ; compound tepal 4·5 cm. long, cream, its lobes orange as in the female flowers, but shorter (scarcely 2 mm. long) ; free tepal white, oblong-lanceolate, as long as the compound tepal and 1 cm. wide, its apex acute and entire ; stamens at first as long as the perianth, later exserted by at least 1 cm., the thecae dark purple, after dehiscence almost black.

Fruit bunch of about 7–8 "hands ", ripening orange-red. Individual fruit 8–10 cm. long, 3 cm. in diameter, distinctly 5-angled at maturity, narrowing rather gradually at base into a short (1–2 cm.) pedicel (which is sometimes pubescent), obtuse at apex, truncate or with a very short, broad, truncate acumen. Pericarp about 3 mm. thick, splitting at full ripeness and curling back in 3–5 irregular valves from the apex ; pulp gamboge yellow. Seeds dull black, irregularly angular, minutely striate but scarcely rough, dorsiventrally flattened, 6 mm. across and 3 mm. high.

Habitat. On banks of the river called on the charts Loloda River, but known to the natives as Soasio River, North Halmaheira, Netherlands East Indies. Described from plants in cultivation at the Imperial College of Tropical Agriculture, Trinidad, B.W.I.

CLASSIFICATION OF THE BANANAS.

III. Critical Notes on Species.

p. Musa maclayi *F. v. Muell. ex Miklouho-Maclay in Proc. Linn. Soc. New South Wales* 10 : 348 (1885).

This imperfectly known species is not in the I.C.T.A. collection, but a brief note on it is included here because it is often overlooked in lists of *Musa* species and has been missed by *Index Kewensis*.

Fig. 1.

Fig. 2.

M. lolodensis sp. nov.

FIG. 1. Male bud in advanced blooming.

FIG. 2. Fruit bunch at maturity ; the upper fruits dehiscing or fallen.

Scales in inches

Photographs by K. S. Dodds

Plate 2

M. coccinea Andr.

Fig. 1. Complete inflorescence at maturity of the fruit, which is visible in the axils of the lower bracts.

Scale in inches

Photograph by K. S. Dodds

The name occurs in a " List of plants in use by the natives of the Maclay-coast, New Guinea " by N. de Miklouho-Maclay in the Proceedings of the Linnean Society of New South Wales, Vol. 10, pp. 346–358. All that appears on p. 348 is : " Besides the cultivated varieties, which have been obtained by exchange between the villages, there is to be found in the forest a *wild* Banana (Musa Maclayi, F. v.M.), compared to the cultivated varieties, with a tall stem (nearly twice as tall), with narrow stiff leaves and small (not edible) fruits full of seeds ".

On p. 355 there commences an appendix by Baron Ferdinand von Mueller as follows : " From notes and drawings furnished by my distinguished friend, I am able to add to his account of *Musa Maclayi*. It belongs to the series of species, which in *M. uranoscopos* has its longest known representative. The flower stalk is upright or but slightly curved ; bracts are red-brownish ; the flowers occur about eight together ; the lobes of the calyx measure nearly an inch in length, the fruits are about three inches long, but hardly more than one inch broad, faintly angular ; the seeds are irregular in shape and often compressed. This *Musa* occurs on swamps and along streams ".

That, so far as I can determine, is all the information available about *M. maclayi* : but it may be enough to identify the species if it is recollected on the Maclay coast. It is at least enough to leave no doubt in my mind that the name represents a distinct member of my section *Australimusa*, related to *M. peekelii* of New Ireland and to an undescribed species in our collection from Buka Island in the Kieta District of New Guinea, as well as to *M. fehi* and the other members of the section.

CLASSIFICATION OF THE BANANAS.

III. Critical Notes on Species.

q. Musa coccinea *Andrews, Bot. Rep. t.* 47 (1797).

This is a very well known species, because its small stature and ornamental inflorescence make it suitable for cultivation in conservatories, and it has therefore become widely distributed in the botanical gardens of Europe. It has probably been introduced also, as an ornamental, to most tropical countries. In describing it Andrews (*The Botanist's Repository, vol.* 1 (1797) *t.* 47) says :

" The honour of having introduced this supremely beautiful plant, pertains to Thomas Evans Esq. of Stepney . . . . . he having received it, amongst many others, about the year 1792 from China, where, as well as in Cochin-China, Sumatra, Java, etc., it is very commonly found . . . . The Musa Coccinea grows to the height of about three, or four feet before it blows, and without question, has no rival but Strelitzia Regina in the hothouse, where its brilliancy tends in some degree to dispel the gloom of winter, for at least three months ".

Andrews also gives a detailed description which need not be reproduced here, as his accompanying plate is quite sufficient to fix the type beyond doubt, and its identity has never been questioned.

J. G. Baker (1893) gives as a synonym of *Musa coccinea* Andr., " *M. Uranoscopos* Lour. Fl. Cochinch. 645, excl. syn. Rumph." and if he is right

Uranoscopos would appear to be the correct epithet for this species, since Loureiro's *Flora Cochinchinensis* antedates Andrews's description by seven years. Loureiro's description is :

Musa Uranoscopos. Chuoi tau.

Differ. spec. Mus. *racemo* erecto : *spathis* partialibus sub-bifloris : *fructu* compresso, polyspermo.

Hab., et notae. *Caulis* 4-pedalis, pollicem crassus. *Folia* linearia, 3-pedalia, 5 pollices lata. *Racemus* erectus, *spathis* linearibus, alternis, coccineis, sub-bifloris, multis. *Bacca* coccinea, ovata, compressa, bi-pollicaris, polysperma, non edulis.

Musa Uranoscopos Rumph. Amb. l. 8. cap. 4. pag. 137. Quae Musa Troglodytarum Lin. sp. 3.

The reference to "Musa Uranoscopos" of Rumphius, re-named *M. Troglodytarum* by Linnaeus, is erroneous ; for those names refer to a very different plant which has been mentioned in these notes in connexion with *M. fehi* Bert. ex Vieill. But Loureiro's description fits *M. coccinea* very well, as far as it goes, and as the epithet *Uranoscopos* had not been taken up by Linnaeus it was available for a different plant.

It would be a pity if the name by which this plant has been generally known for 150 years had now to be changed to meet the rule of priority, and in the circumstances I am glad to find a reason for leaving Andrews's name unchanged. We do not know enough about the species of *Musa* in Indo-China to identify Loureiro's species with the same confidence that we have in *M. coccinea*. I have already mentioned in these notes, when describing *M. laterita*, that there is a species (or possibly more than one) in Siam and Burma that superficially resembles *M. coccinea*. The same may exist in Indo-China, and until the species of that region have been critically re-examined we should refrain from substituting a somewhat doubtful identification for a certain one.

Although the species is almost too well known to need it, I give a description of our material in the form adopted for other species in the I.C.T.A. collection, for the purpose of defining the clone that has been used in genetical experiments. It was obtained from the Royal Botanic Garden in Port of Spain in 1933.

Plant stooling freely ; pseudostems up to 1·5 metres high, 5 cm. in diameter at base, green, devoid of wax ; leaf blades up to 1 m. long, 25 cm. wide, narrowed gradually to a rounded apex, rounded at base with one side usually longer than the other, shining dark green above, paler beneath but not glaucous ; midribs green like the lamina above, paler beneath ; petioles up to 35 cm., with narrow erect margins clasping the pseudostem at base, not becoming scarious.

Inflorescence quite erect, its peduncle scarcely emerging from the sheath of the subtending leaf, the rachis glabrous ; last foliage leaf with reddish petiole ; sterile bracts usually 2, bright scarlet with green leaflike tips ; first fertile bract about 15 cm. long ; flowers of the basal bracts female, from 1 to 4 clusters or occasionally more, upper flowers male.

Female flowers 1–3 per bract ; ovary 3–4 cm. long, 1·5–2 cm. wide, dorsiventrally compressed, orange-yellow, glabrous ; compound tepal

3·5 cm. long, orange-yellow with green lobes, the lateral lobes oval-oblong about 4 mm. long with a spinelike dorsal appendage of about 2 mm., centre lobe smaller and about equal in size to the accessory teeth which are joined to it to form one 3-lobed member ; free tepal as long as the compound, dorsally thickened, opaque, and orange in colour, laterally hyaline ; staminodes short (about 1 cm.) ; style as long as the perianth with a bright orange clavate stigma.

Male bud in advanced blooming very " open ", the bracts persisting unwithered for many days, so that there are finally about 20 open at once, but only the last one or two still with flowers ; closed portion of bud ovoid, the bracts imbricate at the tip ; bracts oblong, lower ones about 7 cm. long, 3 cm. wide, very firm in texture, bright scarlet on both surfaces, not shining on the outside, with the extreme tip yellow or green.

Male flowers 2 per bract ; compound tepal 3·5–4 cm. long, bright orange with green tip and lobes, the lateral lobes 3 mm. long with a spinelike dorsal appendage of about 1 mm., the centre lobe shorter and without appendage, joined to the accessory teeth ; free tepal as long as the compound, narrow oblong, about 7 mm. wide, dorsally thick, opaque, and orange in colour, laterally hyaline, obtuse at apex ; stamens nearly as long as the perianth, but not exserted.

Fruit oblong, 4–5 cm. long, crowned by the persistent withered perianth, 2–2·5 cm. wide, somewhat compressed dorsiventrally, rounded at the sessile base, narrowed to a truncate apex ; pericarp about 1·5 mm. thick, orange-yellow at full maturity with a waxy bloom ; pulp white.

Seeds almost cylindrical, black, about 6 mm. long, a little wider at the top than at the base, with a distinct waist marking the base of the perisperm chamber within, 4 mm. in diameter at the waist, the surface marked with longitudinal warty ridges.

M. coccinea was the earliest described of the species that I group together as *Musa* § *Callimusa*. Its value as an ornamental depends mainly on the persistence of the bracts in a living condition long after the subtended flowers have faded, and as this character is rare in *Musa*, the superficial resemblance of *M. coccinea* to other members of § *Callimusa* is not very close. It belongs there, however, both by its seed shape and by its chromosome number (n=10) ; and its genetical behaviour indicates the same relationship. The only species with which it has been successfully crossed are members of the same section. With *M. borneensis* Becc. it gives a vigorous hybrid, although that species is entirely different in size and habit.

Flora of the Albert National Park, Belgian Congo.—Professor Robyn's flora* of the Albert National Park is almost certainly the most thorough account of the plants of a relatively small area in continental tropical Africa which has yet appeared. The Park is a long narrow irregular area of some 8100 sq. Km. along the Congo–Uganda border stretching from lake Kivu in the south, along the shore of lake Edward to the dense equatorial forests of the Semliki valley north of Ruwenzori in the north. Besides the western part of Ruwenzori the park includes the volcanoes north of lake Kiwu and altitudes within its borders range from 750 to 5000 m. Rainfall varies from about 900 to about 4000 mm. *per annum*. There is thus great variety of habitat and the plant formations include equatorial forest and savannah in the plains, sclerophyllous forest and scrub, mountain rain forest, bamboo forest, tree heather thickets and alpine vegetation as the mountains are ascended. The total number of species recorded is about 2000 which may be compared with a similar number for the British Isles on the one hand and for the much smaller Cape peninsula on the other. This flora is in no sense a mere compilation but is the result of a thorough revision of the species concerned which are described in clear and eminently workable keys. Only in certain cases where the material was destroyed during the war, does it appear that species have been included on the basis of written accounts only. This thoroughness, together with the ample bibliography, make the flora invaluable to any student of the montane vegetation of East or Central Africa. The production is lavish, with excellent full page line drawings to illustrate most of the families, photographs of vegetation and a coloured map of the Park showing the distribution of the main plant formations.

The only criticism to be made is almost inevitable considering that the area of the Park was only finally delimited in 1935 and that it has been investigated by travellers rather than by resident botanists. It is obvious that the earlier collectors would not collect a second time a species already found elsewhere, merely because they had entered what was to become in the future a national park. They collected as fully as possible the plants growing on the high mountains, which were obviously of interest, while the vegetation of the lowlands, which is not very different from that found in adjacent regions was comparatively neglected and it is thus certain that the flora will have to be considerably enlarged when this lowland vegetation has been given the same close attention as that of the peaks. Students of the East African flora, especially of that of Uganda, will find Professor Robyns work of the greatest value. We much look forward to the appearance of the third and last volume, which is to contain accounts of the Monocotyledons.

E. Milne-Redhead.

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*Flore des Spermatophytes du Parc National Albert, by W. Robyns. Institut des Parcs Nationaux du Congo Belge, Bruxelles. Vol. I Gymnospermes and Choripétales, 1948, Vol. II Sympétales, 1947. Price 750 francs each volume.

Cyprus Trees and Shrubs.*—Hitherto there has been little help available to visitors or residents of Cyprus who may be interested in identifying the wild plants of the island. In fact the only work with any claims to completeness, Holmboe's Studies in the Vegetation of Cyprus (1914), has no aids to determination in the form of keys or uniform descriptions, and it has, besides, long been expensive and difficult to obtain. The appearance of Mrs. Chapman's handbook of the trees and shrubs of Cyprus is therefore most welcome, for it is well provided with keys, and each plant mentioned is accompanied by a short and simply worded description. Technical terms are, of course, unavoidable, but the author caters for the untrained reader by a descriptive "introduction to glossary", a glossary and a few diagrammatic figures illustrating the more frequent terms. Probably no author of a handbook has ever written sections corresponding to these to his own complete satisfaction, but Mrs. Chapman has done well and one point of criticism alone needs mention, and that only because it may affect the use of the key to the families. A catkin is defined as a pendulous or drooping spike (pp. 8, 13) : this may cause confusion even amongst the few amentiferous plants of the Cyprus flora, for in *Salix alba* the catkins are not pendulous, while the enthusiastic student may discover that in *Alnus* they are not simple spikes.

The keys, in so far as they have been checked, work well, although a few errors have been noted : for instance, (p. 18) *Berberidaceae* are finally separated by the character " sepals and petals similar, in whorls of 3&3 ", although to reach that point the definition " Embryo with 2 cotyledons, leaves net-veined, flowers 4–5-merous " must have been already accepted. Such errors are, however, not likely to cause serious inconvenience and there seems to be no reason why the agricultural or forestry officer, botanical student or intelligent layman should not, by using these keys, identify the woody plants of Cyprus with reasonable ease. The descriptions given are certainly sufficient to put the matter beyond doubt if read carefully and Mrs. Chapman is greatly to be congratulated on having given all those interested in the Cyprus flora a work of such practical value. In many cases the description of a plant is followed by some brief notes on its occurrence and uses, which add very considerably to the interest of the book.

The professional taxonomist and plant geographer will be interested in two new records for the island : *Ephedra procera* Fisch. & Mey. (p. 23) and *Arbutus unedo* L. (p. 59). It is indeed remarkable that such conspicuous plants should have been so long overlooked. One other record, that of *Staehelina lobeli* (p. 81) has already been published by P. H. Davis (Kew Bull. 1949, 107). It must, indeed, be mentioned that Mrs. Chapman's manuscript became sadly entangled in the delaying web of wartime activities. This is evidenced by the fact that her introduction is dated 1944, 5 years before publication was actually effected. In the intervening period other papers dealing with the Cyprus flora have been published and it is no criticism of Mrs. Chapman's work to indicate a few points which may be brought up to date. The plant referred to as

*Cyprus Trees and Shrubs, by Esther F. Chapman. Pp. 1-88. Cyprus Government Printing Office, Nicosia, 1949. Price 10/-.

Teucrium sp. nov. (p. 67) is *T. cyprium* subsp. *kyreniae* P. H. Davis (in Kew Bull. 1949, 111) ; *Phlomis brevibracteata* Turrill, sp. nov. was published in Gardener's Chronicle, 3 ser. 117 : 48 (1945). The results of H. Lindberg's visit to the island in 1939 have appeared under the title Iter Cyprium*, and while it is not proposed to give here any detailed review of his work, three points affecting the woody vegetation may be mentioned : first, Lindberg describes a new rose under the name *Rosa chionistrae* Lindb. fil. in addition to recording *R. canina* L. and *R. dumetorum* Thuill. ; Mrs. Chapman has 2 species only, *R. dumetorum* Thuill. (as *R. canina var. dumetorum* Baker) and *R. dumalis* Bechst. Clearly the Cyprus roses deserve further study. *Sorbus aria* Crantz of Mrs. Chapman's handbook (p. 42) is equivalent to Lindberg's *Sorbus umbellata* var. *cretica* (Lindl.) C. K. Schneider, and *Pistacia atlantica* Desf. (Chapman, p. 48) is Lindberg's *P. mutica* subsp. *cypricola* (Lindb. f.) Lindb. f.

Mrs. Chapman mentions the following species on the authority of earlier writers, but their occurrence has never been confirmed : *Helianthemum chamaecistus*, *Zizyphus spina-christi*, *Erica verticillata* and *Phillyrea media*. Of these only *Erica verticillata* is vouched for by a specimen in the Kew herbarium : this is the sheet on which Lascelles' original record was based and the locality (previously unpublished) is Karmakiti, where it was found in flower in December 1901. Karmakiti is the cape north of Morphou Bay and it is to be hoped that local botanists will make a determined effort to confirm Lascelles' record, now nearly 50 years old.

B. L. Burtt.

African Birds.*—This is the last volume of this superb work except for a volume of Addenda, received since the first volume was published in 1930. It contains an account of the Weaver birds, Waxbills and Whydahs, with the most exquisitely coloured plates by Lodge, and other drawings of these charming little birds, with descriptions of their nests and eggs and general habits. The Weaver birds are especially interesting from their wonderful nests woven from grass, or strips of palm leaf, hanging in colonies from branches of trees and associated with nests of wasps or viciously stinging flying-ants, or with those of large birds, usually Raptores, Eagles, Hawks, Vultures and Marabout Storks, which act as protectors of the weaver birds, and their homes.

The result of the publication of this splendid work has been most satisfactory, as a very large number of specimens of birds and their eggs and, even more important field observations of their habits have poured into the Natural History Museum, during the appearance of the earlier volumes, and Mr. Bannerman is to be congratulated in producing this great and invaluable work.

H. N. Ridley.

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*Iter Cyprium, contributio ad cognitionem florae insulae Cypri. Harald Lindberg in Acta Soc. Sc. Fenn. nov. ser. B. 2, no. 7, pp. 1-37, ff. 1-24 (1946).

*The Birds of Tropical West Africa, volume VII, pp. 441 with 40 drawings in line and half tone by various artists and 14 coloured plates by George Lodge, by D. A. Bannerman, £2 15s. 0d.

RESEARCHES ON SILENE MARITIMA AND S. VULGARIS : XXXII.

E. M. Marsden-Jones and W. B. Turrill.

Genetical experiments involving plants from the French Alps.

In the last paper in this series we published field notes, scorings of wild populations, and scorings of plants grown from wild collected seed of *Silene alpina* auct., *S. glareosa*, and *S. vulgaris* from the French Alps. In this paper we deal with the results of controlled breeding experiments with some of these plants and of crosses between them and plants of other geographical origins. The following subdivisions of this part of our researches are convenient for presentation of the results :

i. *Silene glareosa.* Descriptions of stock plants. p.
ii. *S. glareosa.* Selfings. p.
iii. *S. glareosa* x *S. glareosa.* p.
iv. *S. alpina.* Descriptions of stock plants. p.
v. *S. alpina.* Selfings. p.
vi. *S. alpina* x *S. alpina.* p.
vii. *S. glareosa* x *S. alpina* and reciprocal. p.
viii. *S. glareosa* x *S. maritima.* p.
ix. *S. alpina* x *S. maritima.* p.
x. *S. glareosa* x *S. vulgaris.* p.
xi. *S. alpina* x *S. vulgaris* and reciprocal. p.
xii. *S. vulgaris*, *S. glareosa*, and *S. alpina* x *S. vulgaris* (Norway). p.
xiii. Selfing of and crosses involving *S. glareosa* from the Tyrol. p.
xiv. Crosses involving *S. glareosa* with emarginate petals. p.

For scoring petal colours we have used the following symbols :

W=White.

X=Upper and lower surfaces very dilute Pale Laelia Pink, veins on lower surface Pale Laelia Pink.

Y=Upper surface Pale Laelia Pink, lower surface Laelia Pink.

Z=Upper surface Laelia Pink, lower surface Tourmaline Pink.

(see Ridgway, Color Standards, Pl. XXXVIII.).

The crossing of *S. glareosa* with *S. vulgaris* from Loch Tay resulted in a modification of the anthocyanin colours recorded for Loch Tay Plants (K.B. 1940, 67). The colour classes accepted in this paper for scoring hybrids so made are :

Dy : upper surface Eupatorium Purple (Ridgway Pl. XXXVIII.); lower surface Vinaceous Purple (Ridgway Pl. XXXVIII.).

My : upper surface Laelia Pink (Ridgway Pl. XXXVIII.), lower surface Tourmaline Pink (Ridgway Pl. XXXVIII.).

Py : both surfaces Pale Laelia Pink (Ridgway Pl. XXXVIII.).

MY : Marguerite Yellow (Ridgway Pl. XXX.).

W=White.

i. Descriptions of stock plants of Silene glareosa.

S. glareosa. K. 1094/11. St. Nizier.

Habit : loose and suberect ; stems up to 4·5 dm. ; medium anthocyanin in vegetative parts ; glabrous.

Leaves : elliptic-linear, acuminate, 2·9 cm. long, 0·7 cm. broad, margins eciliate.

Inflorescence : up to 6 flowered.

Calyx : narrowly subinflated, with medium anthocyanin.

Corolla : colour X, with petals and segments not overlapping ; petals 12 mm. long, 4·5 nm. broad, bilobed, 3/4, boss, anthocyanin blotch absent.

Filaments and anthers : purple.

Sex : female (later hermaphrodite and female).

Stigmata : purple ; immature seeds purple.

Mature seeds : weak tubercled to weak armadillo, with fluctuations.

Ripe capsules : obloid, small, of *S. maritima* type, slightly contracted above, without teeth 5 mm. long, 5·5 mm. broad, mouth 3 mm. diameter, teeth each an isosceles triangle, 2 mm. long, 1·5 mm. broad at base, strongly recurved ; carpophore 2·5 mm. long, 1·5 mm. broad.

Under controlled selfing 8 flowers gave 241 seeds.

S. glareosa. K. 1094/20. St. Nizier.

Habit : suberect, ascending branches, stems up to 3·0 dm. long ; glabrous ; anthocyanin in vegetative parts medium.

Leaves : narrowly elliptic to narrowly lanceolate, acute to very shortly acuminate, 3·0 cm. long, 0·8 cm. broad, margins eciliate.

Inflorescence : 3 to 5 flowered.

Calyx : subinflated, with little anthocyanin.

Corolla : colour X ; with petals and segments not overlapping ; petals 12·5 mm. long, 3·5 mm. broad, bilobed, 3/4, small scale, anthocyanin blotch absent.

Sex : female.

Stigmata : purple ; immature seeds purple.

Ripe capsules : *S. maritima* type, ovoid-obloid.

Mature seeds : weak tubercled to weak armadillo, there is fluctuation in the sample.

Capsules : ovoid-obloid, slightly contracted above, without the teeth 7 mm. long, 7·5 mm. broad, mouth 4 mm. in diameter ; teeth each an isosceles to equilateral triangle, 2 mm. long, 1·5–2 mm. broad at base, strongly recurved ; carpophore 3 mm. long, 2 mm. broad.

S. glareosa. K. 1094/52.

Habit : prostrate, with flowering branches ascending ; stems up to 3·2 dm. long ; medium anthocyanin in vegetative parts ; glabrous.

Leaves : narrowly elliptic-linear, shortly acuminate, 1·7 cm. long, 0·35 cm. broad, margins eciliate.

Inflorescence : up to 7 flowered.

Calyx : subinflated, with medium anthocyanin.

Corolla : colour Y, with petals and segments not overlapping ; petals 15 mm. long, 4·5 mm. broad, bilobed, 3/4, small scale, anthocyanin blotch present.

Filaments and anthers : purple.

Sex : hermaphrodite.

Stigmata : purple ; immature seeds purple.

Mature seeds : armadillo.

Ripe capsules : small, of *S. maritima* type, slightly contracted above, obloid, without teeth 5 mm. long, 6 mm. broad, mouth 4 mm. diameter, teeth each an isosceles triangle, 1·5 mm. long, 1 mm. broad at base, strongly recurved ; carpophore 2 mm. long, 1·5 mm. broad.

Under controlled self-pollination 15 flowers gave 48 seeds.

S. glareosa. K. 1095/14.

Habit : spreading and suberect, stems up to 3·5 dm. long ; little anthocyanin in vegetative parts ; glabrous.

Leaves : elliptic-linear, acuminate, 2·3 cm. long, 0·55 cm. broad, margins eciliate.

Inflorescence : 3 flowered.

Calyx : subinflated, with medium anthocyanin.

Corolla : colour X, with petals and segments not overlapping. Petals 15 mm. long, 4·5 mm. broad, bilobed, 3/4, boss, anthocyanin blotch present.

Filaments and anthers : purple.

Sex : hermaphrodite.

Stigmata : purple ; immature seeds purple.

Mature seeds : armadillo.

Ripe capsules : small, of *S. maritima* type, obloid, slightly contracted above, without the teeth 4·5 mm. long, 6 mm. broad, mouth 3 mm. diameter, teeth each an equilateral triangle, 2 mm. long, 2 mm. broad at base, strongly recurved ; carpophore 2·5 mm. long, 2 mm. broad.

Under controlled self-pollination 33 flowers gave 315 seeds.

S. glareosa. K. 1099/8.

Habit : suberect, ascending branches, stems up to 4·5 dm. long ; glabrous.

Leaves : narrowly elliptic, acute to shortly acuminate, 1·9 cm. long, 0·75 cm. broad, margins eciliate.

Inflorescence : 3–7 flowered.

Calyx : subinflated ; with medium anthocyanin.

Corolla : colour Y, with petals and segments not overlapping. Petals 14 mm. long, 4·5 mm. broad, bilobed, 3/4, boss,anthocyanin blotch present.

Filaments and anthers : purple.

Sex : hermaphrodite.

Stigmata : purple ; immature seeds purple.

Mature seeds : armadillo.

Ripe capsules : small, of *S. maritima* type, obloid, without teeth 5 mm. long, 6 mm. broad ; mouth 3 mm. diameter ; teeth each an isosceles triangle, 2 mm. long, 1·5 mm. broad at base, strongly recurved ; carpophore 3 mm. long, 2 mm. broad.

Under controlled self-pollination 8 flowers gave 20 seeds.

S. glareosa. K. 1099/32.

Habit : erect ; stems up to 3·5 dm. long ; much anthocyanin in vegetative parts ; glabrous.

Leaves : elliptic-linear, acuminate, 2·2 cm. long, 0·55 cm. broad, margins eciliate.

Inflorescence : up to 3 flowered.

Calyx : narrow, with medium anthocyanin.

Corolla : colour Y, with petals and segments not overlapping ; petals 15 mm. long, 4·5 mm. broad, bilobed, 3/4, small scale, anthocyanin blotch absent.

Filaments and anthers : purple.

Sex : hermaphrodite.

Stigmata : purple ; immature seeds white.

Mature seeds : armadillo.

Ripe capsules : small, of *S. maritima* type, obloid, without the teeth 5·5 mm. long, 6·5 mm. broad ; mouth 4 mm. diameter ; teeth each an isosceles triangle, strongly recurved, 2 mm. long, 1·5 mm. broad at base ; carpophore 3 mm. long, 2 mm. broad.

S. glareosa. K. 1099/46.

Habit : spreading, subprostrate, ascending at ends ; stems up to 4·5 dm. long ; medium anthocyanin in vegetative parts ; glabrous.

Leaves : narrowly elliptic, acute to very shortly acuminate, 2·6 cm. long, 0·6 cm. broad, margins eciliate.

Inflorescence : 3 to 4 flowered.

Calyx : narrow, with medium anthocyanin.

Corolla : colour Y, petals and segments not overlapping ; petals 14 mm. long, 6 mm. broad, bilobed, 3/4, boss, anthocyanin blotch present.

Filaments and anthers : purple.

Sex : hermaphrodite.

Stigmata : purple ; immature seeds purple.

Mature seeds : armadillo (slightly verging towards weak armadillo).

Ripe capsules : small, of *S. maritima* type, obloid, without teeth 4·5 mm. long 6 mm. broad ; mouth 3 mm. diameter ; teeth each an isosceles triangle, strongly recurved, 1·5 mm. long, 1 mm. broad at base ; carpophore 2 mm. long, 1·5 mm. broad.

Under controlled selfing 19 flowers produced 250 seeds.

ii. S. GLAREOSA SELFINGS.

N. 199=*S. glareosa* K. 1094/11 selfed. 7 plants in the family.

Stem length : up to 4·5 dm.

Habit : Uniform, loose and suberect.

Anthocyanin in vegetative parts : medium 7.

Leaves : as parent, elliptic-linear, acuminate, 3·2 cm. long, 0·5 cm. broad.

Indumentum : glabrous 7.

Inflorescence : up to 6 flowered.

Anthocyanin in calyx : medium 7.

Calyx : narrowly subinflated 7.

Corolla colour : X 4 : W 3 ; petals : bilobed 7 : 3/4 lobing 7 ; small scales 1 : boss 6 ; anthocyanin blotch : present 3 : absent 4 ; petals and segments not overlapping 7.

Filaments and anthers : purple 5.

Sex : hermaphrodite 5 : female 2.

Stigmata : purple 7.

Immature seeds : purple 2 : white 5.

Mature seeds : tubercled 7.

Capsules : as *S. maritima* and obloid 7.

All died down, no overwatering barren stems.

N. 169=*S. glareosa* K. 1099/32 selfed. 22 plants in the family.

Stem length : up to 3·1 dm.

Habit : erect.

Anthocyanin in vegetative parts : much 22.

Leaves : as parent, elliptic-linear, acuminate, 1·8 cm. long, 0·4 cm. broad.

Indumentum : glabrous 22.

Inflorescence : 3 flowered.

Anthocyanin in calyx : medium 22.

Calyx : narrow 22.

Corolla colour : Y ; petals : bilobed 22, 3/4-lobing 22, boss 22 ; anthocyanin blotch absent 22. Petals and segments not overlapping 22.

Filaments and anthers : purple 3.

Sex : hermaphrodite 2 : hermaphrodite and female 1 : female 19.

Stigmata : purple 22.

Immature seeds : white 18.

Mature seeds : armadillo 18.

Capsules : *S. maritima* type and obloid 21.

All died down, no overwintering barren shoots.

N. 183=*S. glareosa* K. 1094/52 selfed. 1 plant in the family.

Habit : prostrate with flowering branches ascending.

Anthocyanin in vegetative parts : medium.

Indumentum : glabrous.

Inflorescence : 1–4 flowered.

Anthocyanin in calyx : little.

Calyx shape : subinflated.

Corolla colour : white ; petals bilobed, 1/2-lobing, boss, anthocyanin blotch absent, petals and segments not overlapping.

Filaments and anthers : purple.

Sex : hermaphrodite and female.

Stigmata : purple.

Immature seeds : white.

Mature seeds : armadillo.

Capsules : *S. maritima* type and obloid-ovoid.

All died down, no overwintering barren shoots.

N. 185=*S. glareosa* K. 1095/14 selfed. 22 plants in the family.

Stem length : up to 3·6 dm.

Habit : spreading and suberect.

Anthocyanin in vegetative parts : little.

Indumentum : glabrous 22.

Leaves : as parent, elliptic-linear, acuminate, 3·1 cm. long, 0·6 cm. broad, as parent.

Inflorescence : 2 to 7, mostly 3, flowered.

Anthocyanin in calyx : medium (in veins) 22.

Calyx : inflated 2 : subinflated 20.

Corolla colour : X 8 : W 13 ; petals bilobed 22 ; 3/4-lobing 22, boss 22 ; anthocyanin blotch : present 14 : absent 8 ; petals and segments not overlapping 22.

Filaments and anthers : purple 21.

Sex : hermaphrodite 21 : female 1.

Stigmata : purple 22.

Immature seeds : purple 22.

Mature seeds : armadillo 22.

Capsules : *S. maritima* type and obloid 22.

All died down, no overwintering barren shoots.

N. 194=K. 1099 plant 8 selfed. 1 seedling raised but did not flower.

N. 265=K. 1099 plant 8 selfed. No family raised.

N. 179 and **N. 219**=K. 1099 plant 46, selfed. No families raised. The two selfings were made in 1935 and 1936 respectively. Apparently good seed was produced in fair quantity ; 20 capsules from selfed flowers gave 262 seeds. Seed germination failed completely.

iii. S. GLAREOSA x S. GLAREOSA.

N. 211=*S. glareosa* K. 1094/20 x *S. glareosa* K. 1099/8. 14 plants in the family. Under controlled pollination 6 flowers gave 149 seeds.

Stem length : up to 4 dm.

Habit : subprostrate, ascending at ends, spreading.

Anthocyanin in vegetative parts : medium 7 : little 7.

Indumentum : glabrous 14.

Leaves : linear-elliptic to elliptic-linear.

A. 3·0 cm. long, 0·6 cm. broad : 211/4.

B. 1·7 cm. long, 0·2 cm. broad : 211/9, 211/13, 211/5, 211/6.

C. 2·6 cm. long, 0·55 cm. broad : 211/7, 211/10, 211/1, 211/3, 211/8, 211/2, 211/12, 211/11.

Inflorescence : 5 to 9 flowered.

Anthocyanin in calyx : much 5 : medium 9.

Calyx : inflated 5 : subinflated 9.

Corolla colour : W 4 : X 8 : Y 2 ; petals : bilobed 14, 3/4-lobing 14, small scales 2 : boss 12 ; anthocynanin blotch : present 12 : absent 2 ; petals and segments not overlapping 14.

Sex : female 14.

Stigmata : purple 14.

Immature seeds : purple 14.

Mature seeds : armadillo 14.

Capsules : obloid 13 : obloid-ovoid 1. All *S. maritima* type.

N. 212=*S. glareosa* K. 1094/20 x *S. glareosa* K. 1099/46. 10 plants in the family. Under controlled pollination 5 flowers produced 114 seeds.

Stem length : up to 4·9 dm.

Habit : spreading, subprostrate, ascending at ends.

Anthocyanin in vegetative parts : medium 8 : little 2.

Indumentum : glabrous 10.

Leaves : small, narrowly elliptic-linear, acute to shortly acuminate, 1·4 cm. long, 0·3 cm. broad.

Inflorescence : 7 to 13 flowered.

Anthocyanin in calyx : much 1 : medium 9.

Calyx : inflated 3 : subinflated 7.

Corolla colour : W 1 : X 2 : Y 7 ; petals : bilobed 10, 3/4-lobing 10, boss 10.

Anthocyanin blotch : present 8 : absent 2, petals and segments not overlapping 10.

Sex : female 10.

Stigmata : purple 10.

Immature seeds : purple 10.

Mature seeds : tubercled 5 : weak armadillo 2 : armadillo 3.

Capsules : *S. maritima* type and obloid 10.

N. 266=*S. glareosa* K. 1094/20 x *S. glareosa* K. 1095/14. 25 plants in the family.

Stem length : up to 5·6 dm.

Habit : stems suberect, vegetative parts subspreading ; uniform as *S. glareosa* type.

Anthocyanin in vegetative parts : little 25.

Leaves : narrowly elliptic-linear, shortly acuminate, 2·1 cm. long, 0·5 cm. broad.

Indumentum : glabrous 25.

Inflorescence : 5 to 9 flowered.

Anthocyanin in calyx : medium 25.

Calyx : subinflated 25.

Corolla colour : W 13 : X 12 ; petals : bilobed 25, 3/4-lobing 25, scales 4 : small scales 11 : boss 10, anthocyanin blotch : present 6 : absent 19, petals and segments not overlapping 25.

Filaments and anthers : purple 25.

Sex : hermaphrodite 25.

Stigmata : purple 25.

Immature seeds : purple 25.

Mature seeds : weak armadillo 6 : armadillo 19.

Capsules : *S. maritima* type 25, obloid 24 : ovoid 1.

N. 188=*S. glareosa* K. 1094 plant 11 x *S. glareosa* K. 1095 plant 14. Under controlled pollination this cross gave no viable seed.

Silene glareosa, selfings and intraspecific crossings.

On the whole the families raised were small. All plants died down in the winter. Anthocyanin in vegetative parts (much, medium, or little) bred true on selfing except for some segregation in N. 185. On intraspecific crossing, in F_1 segregation occurred except in N. 266. All plants of parents and offspring were glabrous. The number of flowers per inflorescence remained low and ranged from 1 to 7 in families from selfings and 5 to 13 in families from intraspecific crossings. In the parent plants the range was 3 to 7. All plants had anthocyanin in the calyx ; except for one plant (N. 183), selfings bred true as did one family from a cross. Two families from crosses segregated into much and medium anthocyanin. All plants had zygomorphic flowers. Calyx shape bred true on selfing except for some segregation in N. 185. Two families from crossings segregated, and one bred true to the calyx shape of both parents. All families segregated for petal colour, except N. 169 which resulted from a selfing and bred true to the parental colour. All families had bilobed flowers with 3/4-lobing, except one plant with 1/2-lobing (N. 183). The majority of plants in all families except N. 266, had a corona of boss type ; small scales segregated in N. 199 and N. 211, and both scales and small scales in N. 266 (a crossing). Segregation for presence or absence

of anthocyanin blotch occurred in N. 199, N. 185, N. 211, N. 212, and N. 266. In all plants petals and segments were not overlapping. In all plants, filaments, anthers, and stigmata were purple. All crossings gave only plants with immature seeds purple. Segregation in selfings occurred in N. 199 and N. 183. For mature seeds, N. 169, N. 183, and N. 185 bred true to armadillo from selfed armadillo parents. N. 199 gave only tubercled seeds from a selfed parent with seeds fluctuating from weak tubercled to weak armadillo. K. 1094 plant 20 had weak tubercled to weak armadillo seeds. Crossed with three different plants as pollen parents, it gave with K. 1099 plant 8 only armadillo but segregated with K. 1099 plant 46 and K. 1095 plant 14. K. 1099 plant 46 had armadillo seeds verging towards weak armadillo, the other two had armadillo seeds. All plants had capsules of *S. maritima* type.

K. 1094 plant 20 had female (F.) flowers ; K. 1095 plant 14, K. 1099 plant 8, K. 1099 plant 46 had hermaphrodite (H.) flowers. K. 1095 plant 14 selfed gave H. 23 : H.F. 1 : F. 2. Crossings : K. 1094 plant 20 x K. 1099 plant 8 gave F. 14. K. 1094 plant 20 x K. 1099 plant 46 gave F. 10. K. 1094 plant 20 x K. 1095 plant 14 gave H. 25.

One is forced to the conclusion that the pollen parent here genetically contributed to the development of stamens.

iv. Descriptions of stock plants of Silene alpina.

S. alpina K. 1085/5.

Habit : subcompact, spreading outwards at margin ; stems up to 2 dm. long ; medium anthocyanin in vegetative parts ; indumentum short and bristly, few hairs on stems.

Leaves : elliptic, acute or apiculate, 1·2 cm. long, 0·65 cm. broad, margins strongly setulose-ciliate, glaucous-green, densely hairy.

Inflorescence : 1–3 flowered.

Calyx : subinflated ; with much anthocyanin.

Corolla : with petals and segments both diverging ; petal colour X, 12·5 mm. long, 3·5 mm. broad, bilobed, 2/3 lobing, boss, anthocyanin blotch present.

Sex : female (later hermaphrodite and female).

Stigmata : purple ; immature seeds purple.

Ripe capsules : *S. maritima* type, obloid, slightly contracted above, without the teeth 6 mm. long, 7 mm. broad, mouth 4 mm. diameter ; teeth each an isosceles to equilateral triangle, 2 mm. long, 2 mm. broad at base, strongly recurved ; carpophores 3 mm. long, 2 mm. broad.

Mature seeds : armadillo.

S. alpina K. 1085/13.

Habit : subcompact, branches spreading at margin ; stems up to 1·5 dm. long ; medium anthocyanin in vegetative parts ; few short bristly hairs on stems.

Leaves : narrow elliptic tapering to ends, acute, 1·7 cm. long, 0·6 cm. broad, margins strongly setulose-ciliate, glaucous green, with dense short bristly hairs.

Inflorescence : 1–2 flowered.

Calyx : subinflated, with medium anthocyanin.

Corolla : colour X ; petals and segments not overlapping ; petals 12 mm. long, 3 mm. broad, bilobed, 3/4, boss, anthocyanin blotch absent.

Filaments and anthers : purple.

Sex : hermaphrodite.

Stigmata : purple ; immature seeds purple.

Ripe capsules : of *S. maritima* type, obloid, slightly contracted above, without the teeth 6 mm. long, 7 mm. broad, mouth 3·5 mm. diameter ; teeth 2 mm. long, 1·5 mm. broad at base, each an isosceles triangle, strongly recurved ; carpophore 3 mm. long, 2 mm. broad.

Mature seeds : armadillo.

Under controlled selfing 4 flowers produced 47 seeds.

S. alpina K. 1085/15.

Habit : subcompact, spreading outwards at margin ; stems up to 1·5 dm. long ; medium anthocyanin in vegetative parts ; stems glabrous.

Leaves : elliptic, acute, 1·7 cm. long, 0·7 cm. broad, margins strongly setulose-ciliate, glaucous green, indumentum medium of short and bristly hairs.

Inflorescence :1–3 flowered.

Calyx : subinflated ; with medium anthocyanin.

Corolla : with petals and segments both diverging ; petal colour X, 12 mm. long, 3 mm. broad, bilobed, 3/4-lobing, boss, blotch absent.

Sex : female

Stigmata : purple ; immature seeds purple.

Ripe capsules : ovate, of *S. maritima* type, slightly contracted above, without teeth 7 mm. long, 6 mm. broad, mouth 4 mm. diam. ; teeth each an isosceles to equilateral triangle 1·5–2 mm. long, 1·5 mm. broad at base, strongly recurved ; carpophore 3 mm. long, 2 mm. broad.

Mature seeds : armadillo.

S. alpina K. 1085/24.

Habit : compact and branches spreading at margins ; stems up to 1·7 dm. long ; much anthocyanin in vegetative parts ; stems glabrous.

Leaves : elliptic, apiculate, 1·2 cm. long, 0·7 cm. broad, margins setulose-ciliate, green, with few short bristly hairs.

Inflorescence : 1–2 flowered.

Calyx : inflated ; with medium anthocyanin.

Corolla colour X ; with petals and segments not overlapping ; petals 14·5 mm. long, 5·5 mm. broad, bilobed, 3/4 lobing, boss, anthocyanin blotch present.

Filaments and anthers : purple.

Sex : hermaphrodite.

Stigmata : purple ; immature seeds purple.

Mature seeds : armadillo.

Plate 3

Silene glareosa. K. 1094 plant 11.

Plate 4

Silene alpina. K. 1085 plant 24.

Ripe capsules : *S. maritima* type, obloid, slightly contracted above, without the teeth 6 mm. long, 7 mm. broad, mouth 3 mm. diameter ; teeth each an equilateral triangle, 1·5 mm. long, 1·5 mm. broad at base, strongly recurved ; carpophore 3 mm. long, 3·2 mm. broad.

Selfed under control 29 flowers produced 778 seeds.

S. alpina K. 1085/48.

Habit : subcompact, spreading outwards at margin ; stems up to 2 dm. long ; medium anthocyanin in vegetative parts ; stems glabrous.

Leaves : broadly elliptic, acute, 1·3 cm. long, 0·7 cm. broad, margins strongly setulose-ciliate, glaucous-green, indumentum medium of short bristly hairs.

Inflorescence : 1–3 flowered.

Calyx : subinflated ; with much anthocyanin.

Corolla colour Y ; petals 17·5 mm. long, 6 mm. broad, bilobed, 3/4 lobing, boss, blotch present, petals and segments not overlapping.

Sex : hermaphrodite ; anthers purple, filaments purple.

Stigmata : purple ; immature seeds purple.

Ripe capsules : of *S. maritima* type, ovoid, slightly contracted above, without the teeth, 6 mm. long, 5·5 mm. broad ; teeth 1·5 mm. long, 1 mm. broad at base, each an isosceles triangle, strongly recurved ; carpophore 3 mm. long, 1 mm. broad.

Mature seeds : armadillo.

S. alpina K. 1085/57.

Habit : subcompact, spreading ; stems up to 2 dm. long ; much anthocyanin in vegetative parts ; stems glabrous.

Leaves : rounded-elliptic, apiculate, 1·6 cm. long, 1·0 cm. broad, margins with few or no setulose cilia, green, glabrous.

Inflorescence : 1–2 flowered.

Calyx : subinflated, with much anthocyanin.

Corolla colour X ; with petals and segments not overlapping ; petals bilobed, 3/4, boss, anthocyanin blotch present.

Sex : female (later hermaphrodite and female).

Stigmata : purple ; immature seeds purple.

Mature seeds : armadillo.

Ripe capsules : obloid, slightly constricted above, without the teeth 6·5 mm. long, 7·5 mm. broad, mouth 4 mm. diameter ; teeth each an equilateral triangle, 2 mm. long, 2 mm. broad at base, strongly recurved ; carpophore 3·5 mm. long, 2 mm. broad.

Sterility : On selfing under control this plant was almost completely sterile, 40 flowers produced only 9 seeds.

S. alpina K. 1091/4.

Habit : subcompact, branches spreading at margin ; stems up to 2 dm. long ; medium anthocyanin in vegetative parts ; medium short bristly hairs on stems.

Leaves : narrowly elliptic to narrowly elliptic-obovate acuminate to apiculate, 2·1 cm. long, 0·8 cm. broad, margins strongly setulose-ciliate, glaucous geen, with dense short bristly hairs.

Inflorescence : 1–3 flowered.

Calyx : narrow, with medium anthocyanin.

Corolla : Colour X, with petals and segments not overlapping ; petals 15·5 mm. long, 5·5 mm. broad, bilobed, 3/4, boss, anthocyanin blotch absent.

Filaments and anthers : purple.

Sex : hermaphrodite.

Stigmata : purple ; immature seeds purple.

Mature seeds : armadillo.

Ripe capsules : obloid-ovoid, *S. maritima* type, slightly contracted above, without the teeth, 7 mm. long, 7 mm. broad, mouth 3·5 mm. diameter ; teeth each an isosceles triangle, 1·5 mm. long, 1 mm. broad at base, carpophore 3·5 mm. long, 2 mm. broad.

Selfed under control 25 flowers produced 248 seeds.

v. Silene alpina selfings.

N. 165=*S. alpina* K. 1085/24 selfed. 4 plants in the family.

Length of stems up to 1·3 dm.

Habit : uniform as parent.

Anthocyanin in vegetative parts : much 4.

Indumentum : of stem : glabrous 4 ; of leaves : glabrous 2 : few 2.

Inflorescence : 1–2 flowered.

Anthocyanin in calyx : medium 2.

Calyx : inflated 2.

Corolla colour : X (2 not flrd.) ; petals bilobed 2, 3/4-lobing 2, boss 2 ; anthocyanin blotch : present 1 : absent 1 ; not overlapping in both petals and segments 2.

Sex : female 2.

Stigmata : purple 2.

Mature seeds : armadillo 2.

Capsules : *S. maritima* type 2.

No overwintering barren stems.

N. 160=*S. alpina* K. 1085/5 selfed. 2 plants in the family.

Length of stem up to 2 dm.

Habit subcompact, spreading at edges, as parent.

Anthocyanin in vegetative parts : medium.

Indumentum short and bristly : of stems : few hairs ; of leaves : dense.

Inflorescence : 1–2, mostly 1 flowered.

Anthocyanin in calyx : much 2.

Calyx : inflated 2.

Corolla colour : X 2 ; petals bilobed, 3/4 lobing 1 : 2/3 lobing 1, boss 2, anthocyanin blotch : present 1 : absent 1; not overlapping in both petals and segments 2.

Sex : female 2.

Stigmata : purple 2.

Immature seeds : purple 2.

Mature seeds : armadillo 2.

Capsules : *S. maritima* type and obloid 2.

No overwintering barren stems ; plants died down completely.

The following selfings were made from which no families were raised though most often apparently " good " seeds were formed, often in considerable quantity : K. 1085, plants 5, 13, 15, 24, 48, 57; K. 1091, plant 4. Some of these were selfed in two consecutive years with similar results.

vi. Silene alpina x S. alpina.

N. 159=*S. alpine* K. 1085/5 x *S. alpina* K. 1085/13. 8 plants in the family.

Length of stems : up to 2 dm.

Habit : compact centre, suberect flowering branches, as *S. alpina.*

Anthocyanin in vegetative parts : 8 medium.

Indumentum : of stems : dense 1 : few 3 : glabrous 4 ; of leaves : dense 5 : glabrous 3.

Leaves : elliptic to ovate-elliptic, acute, 1·85 cm. long, 1·0 cm. broad.

Inflorescence : 1–2 flowered.

Anthocyanin in calyx : medium 8.

Calyx : inflated 1 : subinflated 7.

Corolla colour : X 2 : W 6 ; petals : bilobed 8, 3/4-lobing 8 ; small scales 2 : boss 6, anthocyanin blotch : present 6 : absent 2.

Overlapping : not overlapping of both petals and segments 8.

Sex : hermaphrodite 8.

Filaments and anthers : purple 8.

Stigmata : purple 8.

Immature seeds : purple 8.

Mature seeds : armadillo 8.

Capsules : *S. maritima* type and obloid 8. All died down, no overwintering barren stems.

N. 164=*S. alpina* K. 1085/24 x *S. alpina* K. 1085/13. 9 plants in the family.

Length of stems : up to 2 dm.

Habit : uniform subprostrate.

Anthocyanin in vegetative parts : much 9.

Indumentum : when present, of short bristles ; of stems : medium 1 : few 3 : glabrous 5 ; of leaves : much 2 : medium 2 : few 1 : glabrous 4.

Leaves : elliptic to narrowly elliptic, apiculate to acute, 1·8 cm. long, 0·8 cm. broad.

Inflorescence : 1–3 flowered.

Anthocyanin in calyx : medium 8.

Calyx : subinflated 8.

Corolla colour : X 6 : Y 2 ; petals : bilobed 8, 3/4-lobing 8, boss 8.

Anthocyanin blotch : present 5 : absent 3, petals and segments not overlapping 7 : petals not overlapping and segments overlapping 1.

Sex : hermaphrodite 1 : female 7.

Filaments and anthers : purple 1.

Stigmata : purple 8.

Immature seeds : purple 8.

Mature seeds : armadillo 8.

Capsules : *S. maritima* type and obloid 8.

All died down, no overwintering barren stems.

Silene alpina, selfings and intraspecific crossings.

Families raised were small though often there was abundant apperently good seed. All plants died down in the winter. Anthocyanin in vegetative parts bred true for medium or much respectively ; two plants with medium on crossing gave medium, but a plant with much, pollinated from one with medium, gave much in all offspring. For indumentum, on selfing one plant bred true and another segregated. Two intraspecific crossings gave segregation for indumentum. The number of flowers per inflorescence was 1 to 3 in all plants. All plants had anthocyanin in calyces. All plants had zygomorphic flowers. Calyx shape of subinflated type did not breed true on selfing but inflated did. Inflated crossed subinflated gave only subinflated. Selfings bred true for petal colour, intraspecific crossings segregated. All plants had bilobed petals and all had 3/4-lobing except K. 1085 plant 5 with 2/3-lobing and the family (N. 160) derived from a selfing of it. All plants had boss corona except in one intraspecific cross which threw 2 plants with small scales. Segregation occurred in all families for presence or absence of blotch. In all plants petals and segments were not overlapping except in one plant (in N. 164) with overlapping segments. All plants had purple stigmata and immature seeds (where scored). All plants had armadillo seeds and *S. maritima* type capsules.

K. 1085 plant 5 had female (F.) flowers in the earlier part and hermaphrodite and female flowers (H.F.) in the later part of the flowering season. K. 1085 plant 13 and K. 1085 plant 24 had hermaphrodite (H.) flowers. K. 1085 plant 5 and K. 1085 plant 24 selfed gave only F. In intraspecific crosses :

K. 1085 plant 24 x K. 1085 plant 13 gave H. 1 : F. 7.

K. 1085 plant 5 x K. 1085 plant 13 gave H. 8.

vii. Silene glareosa x S. alpina and reciprocal.

N. 173=*S. glareosa* K. 1094/11 x *S. alpina* K. 1091/4. 16 plants in the family.

Stem length : up to 2·9 dm.

Habit : intermediate between parents, uniform subcompact centres, spreading and subascending flowering branches.

Anthocyanin in vegetative parts : medium 16.

Indumentum : on stems : medium 1 : few 6 : glabrous 9 ; on leaves : dense 10 : medium 3 : few 1 : glabrous 2.

Leaves : narrowly elliptic-linear, shortly acuminate, 2·4 cm. long, 0·4 cm. broad. Leaves of *S. glareosa* type.

Inflorescence : up to 5 flowered.

Anthocyanin in calyx : much 16.

Calyx : narrow 16.

Corolla colour : W 10 (2 with tinge of colour in veins) : X 6 ; petals : bilobed 16, 3/4-lobing 16, small scale 1 : boss 15, anthocyanin blotch : present 5 : absent 11 ; petals and segments not overlapping 16.

Sex : hermaphrodite 9 : female 7.

Filaments and anthers : purple 9.

Stigmata : purple 16.

Immature seeds : purple 16.

Mature seeds : tubercled 5 : weak armadillo 10 : armadillo 1.

Capsules : *S. maritima* type and obloid 16.

Died down in winter.

N. 356=N. 173/4 selfed. 7 plants in the family.

Stem length : up to 2·8 dm.

Habit : subcompact at centre, stems prostrate and spreading.

Anthocyanin in vegetative parts : medium 7.

Indumentum : on stems medium 3 : few 2 : glabrous 2 ; on leaves medium 1 : few 1 : glabrous 5.

Leaves : As F_1.

Inflorescence : 1/1, 2/6.

Anthocyanin in calyx : medium 7.

Calyx : narrow 7.

Corolla colour : X 7 ; petals : bilobed 7, 3/4-lobing 7, boss 7, anthocyanin blotch : absent 7 ; petals and segments not overlapping 7.

Filaments and anthers : purple 6.

Sex : hermaphrodite 6 : female 1.

Stigmata : purple 7.

Immature seeds : white 2.

Mature seeds : None set.

Capsules : None set.

N. 213=*S. glareosa* K. 1094/20 x *S. alpina* K. 1085/57. 2 plants in the family. Under controlled pollination 3 flowers produced 17 seeds.

Length of stem : up to 3·6 dm.

Habit : subcompact, suberect stems.

Anthocyanin in vegetative parts : medium 1 : little 1.

Indumentum : glabrous 2.

Leaves : intermediate between *S. glareosa* and *S. alpina*, obovate-elliptic, apiculate, 1·5 cm. long, 0·6 cm. broad.

Inflorescence : 7 to 9 flowered.

Anthocyanin in calyx : medium 2.

Calyx : inflated 2.

Corolla colour : W 1 : X 1 ; petals : bilobed 2, 3/4-lobing 2, corona : small scale 1 : boss 1, anthocyanin blotch : absent 2 ; petals not overlapping and segments overlapping 1 : petals and segments not overlapping 1.

Sex : female 2.

Stigmata : purple 2.

Mature seeds : armadillo 1 : weak armadillo (or weak tubercled) 1.

Capsules : *S. maritima* type 2.

N. 203=*S. alpina* K. 1085/57 x *S. glareosa* K. 1099/32. 1 plant in the family.

Length of stem : up to 1·5 dm.

Habit : subspreading or suberect.

Anthocyanin in vegetative parts : medium.

Indumentum : glabrous.

Leaves : narrowly elliptic to elliptic, acute, 1·1 cm. long, 0·5 cm. broad.

Inflorescence : 3 to 5 flowered.

Anthocyanin in calyx : medium.

Calyx : subinflated.

Corolla colour : X ; petals bilobed, 3/4-lobing, boss, anthocyanin blotch absent, petals and segments not overlapping.

Filaments and anthers : purple.

Sex : hermaphrodite.

Stigmata : purple.

Immature seeds : none set.

Capsules : none set.

The following crosses were made which did not yield viable seed :

N. 209=K. 1094 plant 20 x K. 1085 plant 48 (10 selfed flowers gave 290 apparently " good " seeds, but none germinated).

N. 214=K. 1085 plant 57 K. 1099 plant 46 (4 selfed flowers gave 17 apparently " good " seeds, of which none germinated).

Crosses involving S. alpina and S. glareosa.

Only N. 173 gave a family of moderate size and from selfing one plant of this a small F_2 family was obtained. The interesting points in these two families are :

1. The plants died down in the winter when they survived to a second season.
2. There was segregation for indumentum.
3. The leaves were of *S. glareosa* type in both F_1 and F_2.
4. Number of flowers was low.
5. Calyces were all narrow.
6. Segregation occurred for sex in both F_1 and F_2.
7. In F_1 mature seed characters segregated, including some tubercled, showing that the peculiarities of K. 1094 plant 11 influenced the result of an F_1 cross.
8. In F_2 there was complete sterility.

viii. Crosses involving S. glareosa and S. maritima.

N. 163=*S. glareosa* K. 1099 plant 32 x *S. maritima* S.P.A. 20. 67 plants in the family.

Habit : centre compact, flowering stems somewhat spreading and suberect ; all died down but 13 showed a little green ; stems up to 4 dm.

Surface : all glabrous ; all mat.

Leaves : all approximately intermediate (i.e. of H or hybrid type).

Anthocyanin in vegetative parts : medium 67.

Inflorescence : 3 to 7, mostly 3 flowered.

Calyx : subinflated 47 : cylindric 20 ; anthocyanin medium 67.

Corolla colour : W 4 : X 57 : Y 6 ; petals bilobed 64 : multilobed 3, 3/4-lobing 67, boss 6 : small scale 60 : scale 1, anthocyanin blotch present 12 : absent 55, petals overlapping 28 : not overlapping 39, segments overlapping 22 : not overlapping 45.

Sex : hermaphrodite 67.

Androecium : filaments purple 67 ; anthers purple 67.

Gynoecium : stigmata purple 67 ; immature seeds purple 67.

Capsules : *S. maritima* type 44.

Mature seeds : armadillo 39.

Sterility : Very much.

Selfed to produced F_2 family : N. 163 plant 23 : calyx subinflated ; petals X, bilobed, scale, blotch present, petals overlapping segments not overlapping.

N. 330=N. 163 plant 23 selfed. 4 plants in the family.

Habit : centre compact, spreading suberect 2 : spreading subprostrate 1 : erect 1 ; no overwintering barren shoots 2 : very few 2 ; stems up to 3·6 dm.

Surface : all glabrous ; all mat.

Leaves : M 3 : MH 1.

Anthocyanin in vegetative parts : much 2 : medium 1 : none 1.

Inflorescence : Number of flowers 2/2, 3/1, 7/1.

Calyx : subinflated 4 ; anthocyanin much 1 : medium 2 : none 1.

Corolla colour : W 1 : X 3 ; petals bilobed 2 : multilobed 2, 3/4-lobing 4, small scale 2 : scale 2, anthocyanin blotch present 2 : absent 2, petals not overlapping 4, segments overlapping 1 : not overlapping 3.

Sex : hermaphrodite 1 : hermaphrodite and female 1 : female 2.

Androecium : filaments purple 2 ; anthers purple 2.

Gynoecium : stigmata purple 3 ; white 2 ; immature seeds purple 3 : white 1.

Capsules : *S. maritima* type 3.

Mature seeds : armadillo 3.

Sterility : much.

With controlled pollination :

N. 163 plant	Total seeds	Capsules in which seeds contained	Average per capsule
23 selfed	14	54	0·26
19 selfed	36	54	0·67
8 selfed	21	43	0·49
3 selfed	13	51	0·25

N. 168=*S. glareosa* K. 1099 plant 32 x *S. maritima* S.P.A.68. 31 plants in the family.

Habit : centre compact, flowering stems somewhat spreading and suberect ; all died down in winter but 4 showed a little green ; stems up to 4·5 dm.

Surface : all glabrous ; all mat.

Leaves : approximately intermediate.

Anthocyanin in vegegative parts : medium 31.

Inflorescence : number of flowers 1 to 7, mostly 3.

Calyx : subinflated 10 : cylindric 21 ; anthocyanin medium 31.

Corolla colour : X 25 : Y 6 ; petals bilobed 28 : multilobed 3 ; 3/4-lobing 31 ; boss 14 : small scale 17 ; anthocyanin blotch present 7 : absent 24 : petals overlapping 7 : not overlapping 24 : segments overlapping 5 : not overlapping 26.

Sex : hermaphrodite 31.

Androecium : filaments purple 31 ; anthers purple 31.

Gynoecium : stigmata purple 31 ; immature seeds purple 31.

Capsules : *S. maritima* type 31.

Mature seeds : armadillo 31.

Sterility : considerable.

Selfed to produce F_2 families :

N. 167 plant 1 : calyx cylindric ; petals X, multilobed, boss, blotch absent, petals not overlapping segments not overlapping.

N. 167 plant 11 : calyx cylindric ; petals Y, bilobed, small scale, blotch absent, petals overlapping segments not overlapping.

N. 167 plant 28 : calyx subinflated ; petals X, bilobed, boss, blotch absent, petals not overlapping segments overlapping.

N. 334=N. 167 plant 1 selfed. 24 plants in the family.

Habit : compact 23 : subcompact 1 ; spreading and suberect 23 : subprostrate 1 ; overwintering barren shoots present 4 : very few low down 12 ; stems up to 4·5 dm.

Surface : all glabrous ; all mat.

Leaves : M 2 : H M 6 : M H 10 : H 6.

Anthocyanin in vegetative parts : very much 3 : much 8 : medium 13.

Inflorescence : number of flowers 1/1, 2/1, 3/14, 4/3, 5/2, 6/2, 7/1.

Calyx : subinflated 7 : cylindric 17 ; anthocyanin much 3 : medium 18 : little 3.

Corolla colour : W 7 : X 15 : Y 2 ; petals bilobed 7 : multilobed 17 ; 1/3 to 1/2-lobing 1 : 1/2 to 2/3-lobing 3 : 1/2 to 3/4-lobing 1 : 2/3 to 3/4-lobing 1 : 2/3-lobing 2 : 3/4-lobing 16 ; boss 14 : small scale 10 ; anthocyanin blotch present 4 : absent 20 ; petals overlapping 2 : not overlapping 22 ; segments not overlapping 24.

Sex : hermaphrodite 10 : hermaphrodite and female 3 : female 11.

Androecium : filaments purple 12 : white 1 ; anthers purple 13.

Gynoecium : stigmata purple 18 : white 6 : immature seeds purple 17 : white 6.

Capsules : *S. maritima* type 19.

Mature seeds : armadillo 15.

Sterility : much.

N. 331=N. 167 plant 11 selfed. 7 plants in the family.

Habit : compact 4 : subcompact 3 ; spreading and suberect 5 : subprostrate 1 : prostrate 1 ; overwintering barren shoots none or very few and low down ; stems up to 4·3 dm.

Surface : all glabrous ; all mat.

Leaves : M H 4 : H 3.

Anthocyanin in vegetaive parts : much 5 : medium 2.

Inflorescence : number of flowers 3/3, 5/1, 6/2, 9/1.

Calyx : subinflated 1 : cylindric 6 ; anthocyanin much 3 : medium 4.

Corolla colour : W 6 : Y 1 ; petals bilobed 5 : multilobed 2 ; 3/4-lobing 7 ; boss 6 : small scale 1 ; anthocyanin blotch present 3 : absent 4 ; petals not overlapping 7 ; segments not overlapping 7.

Sex : hermaphrodite 4 : hermaphrodite and female 2 : female 1.

Androecium : filaments purple 6 ; anthers purple 6.

Gynoecium : stigmata purple 7 : immature seeds purple 4 : white 3.

Capsules : *S. maritima* type 4.

Mature seeds : weak tubercled 1 : armadillo 3.

Sterility : much.

N. 333=N. 167 plant 28 selfed. 6 plants in the family.

Habit : compact 5 : subcompact 1, spreading and suberect 6 ; overwintering barren shoots some or few and low down, stems up to 3·2 dm.

Surface : all glabrous, all mat.

Leaves : H 6.

Anthocyanin in vegetative parts : much 2 : medium 4.

Inflorescence : number of flowers 3/2, 4/2, 7/2.

Calyx : inflated 2 : subinflated 4 ; anthocyanin medium 5 : little 1.

Corolla colour : W 5 : Y 1 ; petals bilobed 5 : multilobed 1 ; 2/3-lobing 1 : 2/3 to 3/4-lobing 1 : 3/4-lobing 4 ; boss 3 : small scale 2 : scale 1 ; anthocyanin blotch absent 6 ; petals overlapping 1 : not overlapping 5 ; segments overlapping 1 : not overlapping 5.

Sex : hermaphrodite 4 : hermaphrodite and female 2.

Androecium : filaments purple 5 ; anthers purple 5.

Gynoecium : stigmata purple 6 ; immature seeds purple 6.

Capsules : *S. maritima* type 3.

Mature seeds : armadillo 3.

Sterility : very much.

With controlled pollination :

N. 167 plant	Total seeds	Capsules in which seeds contained	Average per capsule
1	88	47	1·87
11	89	71	1·25
28	19	63	0·30

N. 210=*S. glareosa* K. 1094 plant 20 x *S. maritima* S.P.A.70. 66 plants in the family. Under controlled pollination 11 flowers gave 358 seeds.

Habit : all sub-compact with flowering stems ascending ; overwintering barren shoots absent ; stems up to 6·7 dm.

Surface : all glabrous ; all mat.

Leaves : intermediate.

Anthocyanin in vegetaive parts : much 1 : medium 58 : little 7.

Inflorescence : number of flowers 3/1, 5/4, 6/7, 7/40, 8/5, 9/6, 10/2, 11/1.

Calyx : inflated 19 : subinflated 44 : cylindric 3 ; anthocyanin much 4 ; medium 61 : little 1.

Corolla colour : W 34 : X 26 ; petals bilobed 64 : multilobed 2 ; 3/4-lobing 66 ; small scale 49 : scale 17 ; anthocyanin blotch absent 66 ; petals not overlapping 66 ; segments not overlapping 66.

Sex : female 66.

Gynoecium : stigmata purple 66 ; immature seeds purple 66.

Capsules : *S. maritima* type 64.

Mature seeds : weak tubercled 9 : weak armadillo 28 : armadillo 3 : mixed 23.

Sterility : not marked, except in a few plants.

N. 182=*S. glareosa* K. 1099 plant 32 x *S. maritima* S.P.A.70. 40 plants in the family.

Habit : centre compact, flowering branches suberect ; overwintering barren shoots absent except a little green in 8 ; stems up to 3·7 dm.

Surface : all glabrous ; all mat.

Leaves : intermediate.

Anthocyanin in vegetaive parts : medium 40.

Inflorescence : number of flowers 3 to 7, mostly 3.

Calyx : subinflated 39 : cylindric 1 ; anthocyanin medium 40.

Corolla colour : W 6 : X 26 : Y 8 ; petals bilobed 40 ; 3/4-lobing 40 ; boss 10 : small scale 30 ; anthocyanin blotch present 5 : absent 35 ; petals overlapping 9 : not overlapping 31 ; segments overlapping 10 : not overlapping 30.

Sex : hermaphrodite 40.

Androecium : filaments purple 40 ; anthers purple 40.

Gynoecium : stigmata purple 40 ; immature seeds purple 40.

Capsules : *S. maritima* type 40.

Mature seeds : armadillo 40.

Sterility : not marked.

Selfed to produce F_2 families :

N. 182 plant 2 : calyx subinflated, petals X, small scale, blotch absent, petals overlapping segments not overlapping.

N. 182 plant 19 : calyx subinflated ; petals X, small scale, blotch absent, petals not overlapping, segments not overlapping.

N. 182 plant 25 : calyx subinflated ; petals Y, small scale, blotch absent, petals overlapping, segments overlapping.

N. 327=N. 182 plant 2 selfed. 5 plants in the family.

Habit : compact 2 : subcompact 3, spreading and suberect 5 ; overwintering barren shoots very few and low down ; stems up to 5 dm.

Surface : all glabrous ; all mat.

Leaves : M 5.

Anthocyanin in vegetative parts : much 3 : medium 2.

Inflorescence : Number of flowers 3.

Calyx : inflated 1 : subinflated 3 : cylindric 1 ; anthocyanin much 5.

Corolla colour : W 4 : X 1 ; petals bilobed 5 ; 3/4-lobing 5 ; small scale 5 ; anthocyanin blotch absent 5 ; petals not overlapping 5 ; segments not overlapping 5.

Sex : hermaphrodite 3 : hermaphrodite and female 1 : female 1.

Androecium : filaments purple 4 ; anthers purple 4.

Gynoecium : stigmata purple 5 ; immature seeds purple 4 : white 1.

Capsules : *S. maritima* type 5.

Mature seeds : armadillo 4.

Sterility : much.

N. 325=N. 182 plant 19 selfed. 67 plants in the family.

Habit : compact 51 : subcompact 16, branches spreading and suberect 55 : erect 11 : subprostrate 1 ; overwintering barren shoots 4 present and 14 with little green ; stems up to 4·5 dm.

Surface : all glabrous ; all mat.

Leaves : all of narrow *S. maritima* type.

Anthocyanin in vegetative parts : much 27 : medium 38 : little 1.

Inflorescence : number of flowers 1/1, 2/10, 3/46, 4/1, 5/4, 7/5.

Calyx : inflated 7 : subinflated long 3 : subinflated 29 : long cylindric 16 : cylindric 12 ; anthocyanin much 22 : medium 33 : little 11.

Corolla colour : W 40 : X 23 ; petals bilobed 64 : multilobed 3 ; 1/2-lobing 1 : 1/2 to 3/4-lobing 1 : 2/3 to 3/4-lobing 2 : 3/4-lobing 63 ; boss 8 : boss to small scale 2 : small scale 49 : scale 8 ; anthocyanin blotch absent 66 ; petals overlapping 12 : not overlapping 54 ; segments overlapping 9 : not overlapping 57.

Sex : hermaphrodite 47 : hermaphrodite and female 11 : female 9.

Androecium : filaments purple 57 ; anthers purple 58.

Gynoecium : stigmata purple 61 : white 5 ; immature seeds purple 54 : white 10.

Capsules : *S. maritima* type 55.

Mature seeds : armadillo 58.

Sterility : marked, except in a few plants.

N. 326=N. 182 plant 25 selfed. 5 plants in the family.

Habit : compact 3 : subcompact 2, spreading and suberect 4 : subprostrate 1 ; overwintering barren shoots absent ; stems up to 4 dm.

Surface : all glabrous ; all mat.

Leaves : M 4 : M H 1.

Anthocyanin in vegetative parts : much 2 : medium 3.

Inflorescence : number of flowers 3/1, 4/2, 6/1, 7/1.

Calyx : inflated 1 : cylindric 4 ; anthocyanin much 1 : medium 4.

Corolla colour : W 3 : X 2 ; bilobed 4 : multilobed 1 ; 3/4-lobing 5 ; scale 3 : small scale 2 ; anthocyanin blotch present 1 : absent 4 ; petals overlapping 2 : not overlapping 3 ; segments overlapping 1 : not overlapping 4.

Sex : hermaphrodite 2 : hermaphrodite and female 2 : female 1.

Androecium : filaments purple 4 ; anthers purple 4.

Gynoecium : stigmata purple 4 : white 1 ; immature seeds purple 4 : white 1.

Capsules : *S. maritima* type 3.

Mature seeds : armadillo 2.

Sterility : much.

With controlled pollination :

N. 182 plant	Total seeds	Capsules in which seeds contained	Average per capsule
2	49	68	0·72
19	353	58	6·09
25	17	68	0·25

The families dealt with in this section are :

N. 163=K. 1099 plant 32 x S.P.A.20.

N. 330=N. 163 plant 23 selfed.

N. 167=K. 1099 plant 32 x S.P.A.68.

N. 334=N. 167 plant 1 selfed.

N. 331=N. 167 plant 11 selfed.

N. 333=N. 167 plant 28 selfed.

N. 210=K. 1094 plant 20 x S.P.A. 70.

N. 182=K. 1099 plant 32 x S.P.A.70.

N. 327=N. 182 plant 2 selfed.

N. 325=N. 182 plant 19 selfed.

N. 326=N. 182 plant 25 selfed.

In the results, points to be particularly noted are :

1. *Winter condition.* Some undoubted indications of intermediate development with segregation.

2. *Anthocyanin in vegetative parts and calyx* gave medium from crossing, in N. 163, of plants with much in vegetative parts and medium in calyx and with none in both. In F_2 there was clear-cut segregation in the ratio much 2 : medium 1 : none 1 in vegetative parts and much 1 : medium 2 : none 1 in calyx.

3. *Leaf shape.* All F_1 families were intermediate. Summated F_2 families gave M 81 : H M 6 : M H 16 : H 15 (M=of *S. maritima* type, H=of hybrid type).

4. *Number of flowers.* These were mostly 3 to 7 (rarely to 9 or 11).

5. *Calyx shape.* The results may be tabulated as follows :

N. 163.	N x I
F_1	S 47 : N 20
F_2	S 4
N. 167	N x N
F_1	S 10 : N 21
F_2 (from S)	I 2 : S 4
F_2 (from N)	S 7 : N 17
F_2 (from N)	S 1 : N 6
N. 210	I x L
F_1	I 19 : S 44 : N 3
N. 182	N x L
F_1	S 39 : N 1

F_2s (from S), summated, I 7 : S L 3 : S 29 : L N 16 : N 12.

[I=inflated, S=subinflated, N=narrow, L=long narrow].

6. *Petal colour.*

N. 210=X x W

F_1 W 34 : X 26

F_1s of Y x W summated gave : W 10 : X 108 : Y 20

F_2s from Y x W summated gave : W 66 : X 44 : Y 4.

7. *Sex.*

	H x H F
F_1	H 67
F_2	H 1 : H F 1 : F 2
	H x H F
F_1	H 31
F_2s	H 18 : H F 7 : F 12
	F x H
F_1	F 66
	H x H
F_1	H 40
F_2	H 52 : H F 14 : F 11.

8. *Seeds.* All plants had armadillo seeds in N. 163, N. 167, and N. 182 and in derived F_2 families, except for one plant in N. 331 with weak tubercled seeds. In N. 210 there was segregation within the range of the parents, but with somatic differentiation in 23 plants.

9. *Capsules* were all of *S. maritima* type.

10. *Sterility*. There was much to very much in all families except N. 210 and N. 182, where it only occurred in a few plants, both F_1 families. It was marked in all F_2 families.

ix. Crosses involving S. alpina and S. maritima.

N. 162=*S. alpina* K. 1085 plant 5 x *S. maritima* S.P.A.20. 68 plants in the family.

Habit : centre compact, flowering stems spreading and ascending ; all died down but 12 showed a little green ; stems up to 4 dm.

Surface : stems, hairs medium 3 : few 15 : glabrous 50 ; leaves, hairs dense 2 : medium 12 : few 11 : glabrous 43 ; all mat.

Leaves : approximately intermediate.

Anthocyanin in vegetative parts : medium 68.

Inflorescence : number of flowers 1 to 7, mostly 3.

Calyx : inflated 42 : subinflated 26 ; anthocyanin medium 68.

Corolla colour : W 26 : X 40 : Y 2 ; petals bilobed 47 : multilobed 21 ; 3/4-lobing 68 ; boss 33 : small scale 35 ; anthocyanin blotch present 37 : absent 31 ; petals overlapping 44 : not overlapping 24 ; segments overlapping 54 : not overlapping 14.

Sex : hermaphrodite 57 : hermaphrodite and female 4 : female 7.

Androecium : filaments purple 58 : white 3 ; anthers purple 61.

Gynoecium : stigmata purple 68 ; immature seeds purple 67.

Capsules : *S. maritima* type 58.

Mature seeds : armadillo 59.

Sterility : very considerable.

Characters of *S. maritima* parents :

S.P.A. 20 : leaves linear to narrowly linear-lanceolate, no anthocyanin in vegetative parts, calyx inflated with no anthocyanin, petals and segments scarcely contiguous bilobed 3/4-lobing small scale no blotch, hermaphrodite and female, filaments white, stigmata white, immature seeds purple, *S. maritima* type capsules, seeds armadillo.

S.P.A.68 : leaves linear or narrowly lanceolate- or oblanceolate-linear, much anthocyanin in vegetative parts, calyx cylindric with much anthocyanin, petals white multilobed 3/4-lobing scale blotch present petals and segments not overlapping, hermaphrodite and female, filaments, anthers, stigmata, and immature seeds purple, *S. maritima* type capsule, seeds armadillo (see Journ. Ecol. **26,** 365 : 1938, for fuller description).

S.P.A.70 : leaves linear to oblanceolate linear, much anthocyanin in vegetative parts, calyx long cylindric with medium anthocyanin, petals white 3/4-lobing small scale no blotch petals more or less not overlapping, segments overlapping, hermaphrodite, filaments, anthers, stigmata, and seeds purple, *S. maritima* type capsules seeds armadillo (see K.B. 1939, 298, for fuller description).

For K. 1085 plant 5 ; K. 1085 plant 13 ; K. 1085 plant 24 ; K. 1099 plant 32 see earlier part (selfings of *S. alpina* and *S. glareosa*).

Selfed to produce F_2 families :

N. 162 plant 23 : stem hairs few, leaf hairs medium, calyx subinflated, petals X, bilobed small scale no blotch not overlapping, segments overlapping, hermaphrodite, filaments purple.

N. 162 plant 64 : stem glabrous, leaf hairs few, calyx inflated, petals Y multilobed small scale no blotch overlapping, segments overlapping, hermaphrodite, filaments purple.

N. 323=N. 162 plant 23 selfed. 9 plants in the family.

Habit : all compact, suberect 5 : subprostrate 3 ; no overwintering shoots 6 : few green shoots and these low down 3 ; stems up to 2·3 dm.

Surface : stem and leaves, hairs few 2 : glabrous 7 ; all mat.

Leaves : M 7 : H M 2.

Anthocyanin in vegetative parts : much 3 : none 6.

Inflorescence : number of flowers 1/1, 2/1, 3/6.

Calyx : inflated 3 : subinflated 5 ; anthocyanin much 2 : medium 1 : none 5.

Corolla colour : W 5 : X 3 ; petals bilobed 8 ; 1/2-lobing 1 : 2/3-3/4-lobing 3 : 3/4-lobing 4 ; boss 6 : small scale 2 ; anthocyanin blotch present 1 : absent 7 ; petals not overlapping 7 ; segments overlapping 1 : not overlapping 6.

Sex : hermaphrodite 1 : hermaphrodite and female 3 : female 4.

Androecium : filaments purple 1 : white 3 ; anthers purple 3.

Gynoecium : stigmata purple 3 : white 5 ; immature seeds purple 8.

Capsules : *S. maritima* type 2.

Mature seeds : armadillo 3.

Sterility : very great.

N. 332=N. 162 plant 64 selfed. 4 plants in the family.

Habit : centre compact 4, flowering stems spreading and subprostrate 4 ; no overwintering barren shoots ; stems up to 2·4 dm.

Surface : all glabrous ; all mat.

Leaves : M 3 : HM 1.

Anthocyanin in vegetative parts : medium 1 : none 3.

Inflorescence : number of flowers 1/2, 2/1, 3/1.

Calyx : inflated 1 : subinflated 3 ; anthocyanin medium 1 : none 3.

Corolla colour : W 3 : X 1 ; petals bilobed 1 : multilobed 3 ; 2/3-3/4-lobing 1 : 3/4-lobing 3 ; boss 2 : small scale 2 ; anthocyanin blotch absent 4 ; petals overlapping 1 : not overlapping 3 ; segments not overlapping 4.

Sex : hermaphrodite and female 1 : female 3.

Androecium : filaments purple 1 ; anthers purple 1.

Gynoecium : stigmata purple 1 : white 3 ; immature seeds purple 4.

Capsules : *S. maritima* type 3.

Mature seeds : armadillo 3.

Sterility : very considerable.

With controlled pollination :

N. 162 plant	Total seeds	Capsules in which seeds contained	Average per capsule
23 selfed	142	49	2·90
64 selfed	50	60	0·83
4 selfed	0	32	0
27 selfed	40	26	1·54

N. 168=*S. alpina* K. 1085 plant 24 x *S. maritima* S.P.A.68. 70 plants in the family.

Habit : centre compact, flowering stems spreading and ascending ; all[1] died down except 5 which showed a little green ; stems up to 3 dm.

Surface : all glabrous ; all mat.

Leaves : intermediate.

Anthocyanin in vegetative parts : much 70.

Inflorescence : number of flowers 1–3.

Calyx : inflated 1 : subinflated 62 : cylindric 7 ; anthocyanin medium 70.

Corolla colour : W 26 : X 42 : Y 2 ; petals bilobed 67 : multilobed 3 ; 3/4-lobing 70 ; boss 51 : small scale 19 ; anthocyanin blotch present 45 : absent 25 ; petals overlapping 33 : not overlapping 37 ; segments overlapping 27 : not overlapping 43.

Sex : hermaphrodite 63 : hermaphrodite and female 2 : female 5.

Androecium : filaments purple 65 ; anthers purple 65.

Gynoecium : stigmata purple 70 ; immature seeds purple 70.

Capsules : *S. maritima* type 69.

Mature seeds : armadillo 46 : weak armadillo 14 : armadillo and weak armadillo 9.

Sterility : no marked sterility except in a few plants.

Selfed to produce F_2 families :

N. 168 plant 64 : calyx subinflated, petals Y bilobed small scale blotch present overlapping, segments not overlapping, hermaphrodite, seeds armadillo.

N. 168 plant 68 : calyx cylindric, petals X bilobed small scale blotch present overlapping, segments overlapping, hermaphrodite, seeds armadillo.

N. 105=S.P.A.68 selfed. 91 plants in the family.

Habit, *leaves*, and *inflorescence* as in parent.

Calyx : inflated 1 : cylindric 90 ; anthocyanin very much 4 : much 40: medium 45 : little 2.

Corolla colour : pink (upper and lower surface Laelia Pink, lower surface veined Tourmaline Pink) 1 : white 90 ; petals bilobed 69 : multilobed 22 ; 3/4-lobing 91 ; small scale 27 : scale 64 ; anthocyanin blotch present 87 : absent 4 ; petals overlapping 81 : not overlapping 11 ; segments overlapping 46 : not overlapping 45.

Sex : hermaphrodite 58 : hermaphrodite and female 18 : female 14.

Androecium : filaments purple 49 : white 24 ; anthers purple 73.

Gynoecium : stigmata purple 69 : white 22 ; immature seeds purple 89.

Capsules : all *S. maritima* type.

Seeds : all armadillo.

N. 340=N. 168 plant 64 selfed. 10 plants in the family.

Habit : centre compact, flowering stems spreading and suberect 5 : spreading and subprostrate 5 ; some overwintering green shoots ; stems up to 2·4 dm.

Surface : all glabrous : all mat.

Leaves : HM 6 ; H 4.

Anthocyanin in vegetative parts : very much 7 : much 2 : medium 1.

Inflorescence : number of flowers 1/1, 2/1, 3/8.

Calyx : inflated 3 : subinflated 6 : cylindric 1 ; anthocyanin medium 6 : much 4.

Corolla colour : X 9 : Y 1 ; petals bilobed 10 ; 2/3-lobing 2 : 3/4-lobing 8 ; boss 9 : small scale 1 ; anthocyanin blotch present 2 : absent 8 ; petals overlapping 1 : not overlapping 8 ; segments overlapping 5 : not overlapping 5.

Sex : hermaphrodite 1 : hermaphrodite and female 1 : female 8.

Androecium : filaments purple 2 : white 1 ; anthers purple 2.

Gynoecium : stigmata purple 6 : white 4 ; immature seeds purple 10.

Capsules : *S. maritima* type 7.

Mature seeds : armadillo 3 : weak armadillo 5.

Sterility : fair amount.

N. 329=N. 168 plant 68 selfed. 13 plants in the family.

Habit : centre compact, flowering stems spreading and suberect 11 : spreading and subprostrate 2 ; with very few green overwintering shoots low down 8 ; stems up to 3 dm.

Surface : all glabrous ; all mat.

Leaves : HM 1 : MH 3 : H 9.

Anthocyanin in vegetative parts : very much 11 : much 2.

Inflorescence : number of flowers 3/12, 5/1.

Calyx : subinflated 6 : cylindric 7 ; anthocyanin medium 13.

Corolla colour : W 5 : X 8 ; petals bilobed 10 : multilobed 3 ; 2/3 to 3/4-lobing 1 : 3/4-lobing 12 : boss 8 : boss to small scale 1 : small scale 4 ; anthocyanin blotch present 9 : absent 4 ; petals not overlapping 13 ; segments overlapping 7 : not overlapping 6.

Sex : hermaphrodite 11 : hermaphrodite and female 2.

Androecium : filaments purple 13 ; anthers purple 13.

Gynoecium : stigmata purple 11 : white 2 ; immature seeds purple 13.

Capsules : *S. maritima* type 8.

Mature seeds : armadillo 8 : weak armadillo 1.

Sterility : marked.

With controlled pollination :

N. 168 plant	Total seeds	Capsules in which seeds contained	Average for capsule
64 selfed	71	26	2·73
68 selfed	40	17	2·35

N. 176=*S. alpina* K. 1085 plant 13 x *S. maritima* S.P.A.70. 70 plants in the family.

Habit : centre compact, flowering stems somewhat spreading and suberect ; died down in winter but 19 showed a little green ; stems up to 3 dm.

Surface : hairs on stems dense 31 : medium 17 : few 2 : glabrous 20 ; hairs on leaves dense 49 : few 20 : glabrous 1 ; all mat.

Leaves : an obvious range in leaf shape from near to K. 1085 plant 13 to near to S.P.A.70.

Anthocyanin in vegetative parts : much 70.

Inflorescence : number of flowers 1 to 3.

Calyx : inflated 5 : subinflated 64 : cylindric 1 ; anthocyanin medium 70.

Corolla colour : W 60 : X 10 ; bilobed 70 ; 3/4-lobing 70 ; small scale 69 : scale 1 ; anthocyanin blotch present 31 : absent 39 ; petals overlapping 19 : not overlapping 51 ; segments overlapping 67 : not overlapping 3.

Sex : hermaphrodite 69 : hermaphrodite and female 1.

Androecium : filaments purple 70 ; anthers purple 70.

Gynoecium : stigmata purple 70 ; immature seeds purple 70.

Capsules : *S. maritima* type 70.

Mature seeds : tubercled 20 : weak tubercled 7 : armadillo 32 : weak armadillo 4 : mixtures 7. In plants 34 and 39 all 4 types of seeds were present in single capsules.

Sterility : no general sterility.

Selfed to produce F_2 families :

N. 176 plant 6 : hairs on stems and leaves dense, leaf shape near to K. 1085 plant 13, calyx inflated, petals X small scale blotch present overlapping, segments overlapping, hermaphrodite, seeds tubercled.

N. 328=N. 176 plant 6 selfed. 8 plants in the family.

Habit : compact 5 : subcompact 2 : subspreading 1 ; flowering stems spreading and suberect 8 ; overwintering barren shoots present in good numbers 2 : very few and low down 6 ; stems up to 3·6 dm.

Surface : hairs on stems dense 1 : medium 4 : glabrous 3 ; hairs on leaves dense 4 : medium 1 : glabrous 3 ; all mat.

Leaves : HM 1 : MH 1 : H 1 : AH 4 : HA 1.

Anthocyanin in vegetative parts : much 5 : medium 3.

Inflorescence : number of flowers 1/1, 2/1, 3/4, 7/2.

Calyx : very inflated 1 : inflated 3 : subinflated 4 ; anthocyanin much 1 : medium 6 : little 1.

Corolla colour : W 6 : X 2 ; petals bilobed 6 : multilobed 2 ; 2/3-lobing 1 : 3/4-lobing 7 ; small scale 4 : scale 4 ; anthocyanin blotch present 4 : absent 4 ; petals overlapping 3 : not overlapping 5 ; segments overlapping 4 : not overlapping 4.

Sex : hermaphrodite 3 : hermaphrodite and female 1 : female 4.

Androecium : filaments purple 4 ; anthers purple 4.

Gynoecium : stigmata purple 8 ; immature seeds purple 8.

Capsules : *S. maritima* type 5.

Mature seeds : tubercled 2 : armadillo 2.

Sterility : considerable.

With controlled pollination of 28 flowers, 76 seeds were set, an average of 2·72 per capsule.

The families dealt with in this section are :

N. 162=K. 1085 plant 5 x S.P.A.20.

N. 323=N. 162 plant 23 selfed.

N. 332=N. 162 plant 64 selfed.

N. 168=K. 1085 plant 24 x S.P.A.68.

N. 105=S.P.A.68 selfed.

N. 340=N. 168 plant 64 selfed.

N. 329=N. 168 plant 68 selfed.

N. 176=K. 1085 plant 13 x S.P.A.70.

N. 328=N. 176 plant 6 selfed.

In the results, points to be particularly noted are :

1. *Winter condition.* *S. alpina* and *S. glareosa* resemble *S. vulgaris* in this respect and contrast with *S. maritima.* Most F_1 and F_2 families showed some green shoots but these were low down. There was some suggestion of an intermediate development of the character.

2. *Anthocyanin in vegetative parts.* In N. 162, medium x none gave medium which on selfing segregated into (a) much and none and (b) medium and none in different F_2 families. In N. 168, much x much gave much which on selfing gave (a) very much, much, and medium and (b) very much and much in different F_2 families. The *S. maritima* parent on selfing gave very much, much, medium, and little.

3. *Indumentum.* Hairs, when present, were of the short bristly type and the genes responsible for indumentum were introduced by *S. alpina*, all three *S. maritima* parents being quite glabrous. Families N. 332, N. 168, N. 340, and N. 329 had only glabrous plants. The remaining F_1 and F_2 families segregated, as was to be expected.

4. *Leaf shape.* Using the symbols M for *S. maritima* parental type, A for *S. alpina* parental type, and H for hybrid (F_1) type results were obtained as follows :

N. 162		A x M
	F_1	H
	F_2	M 7 : HM 2
	F_2	M 3 : HM 1
N. 168		A x M
	F_1	H
	F_2	HM 6 : H 4
	F_2	HM 1 : MH 3 : H 9
N. 176		A x M
	F_1	range in family ; HA type selfed
	F_2	HM 1 : MH 1 : H 1 : AH 4 : HA 1

5. Flower number throughout was low and ranged from 1 to 7

6. The crossings involved plants with inflated (I), subinflated (S), narrow or cylindric (N), or long cylindric (L) calyces, and gave the following results :

N. 162		S x I
	F_1	I 42 : S 26
	F_2s	I 1 : S 3 ; I 3 : S 5
N. 168		I x N
	F_1	I 1 : S 62 : N 7
	F_2s	I 3 : S 6 : N 1 ; S 6 : N 7
N. 176		S x L
	F_1	I 5 : S 64 N 1
	F_2	+I 1 : I 3 : S 4

7. *Petal colour*

N. 162 X x W

F_1 W 26 : X 40 : Y 2

F_2s W 5 : X 3 ; W 8 : X 1

N. 168 X x W

F_1 W 26 : X 42 : Y 2

F_2s W 5 : X 8 ; X 9 : Y 1

N. 176 X x W

F_1 W 60 : X 10

F_2 W 6 : X 2

8. Sex.

N. 162 HF x HF

F_1 H 57 : HF 4 : F 1

F_2 H 1 : HF 3 : F 4

F_2 HF 1 : F 3

N. 168 H x HF

F_1 H 63 : HF 2 : F 5

F_2 H 1 : HF 1 : F 8

F_2 H 11 : HF 2

N. 176 H x H

F_1 H 69 : HF 1

F_2 H 3 : HF 4.

9. All plants had armadillo seeds in N. 162, N. 323, and N. 332. In British and much continental material of *S. vulgaris* and *S. maritima*, and in crosses between these two species, armadillo is recessive to tubercled. Some factors modifying these characters have, however, been recorded. In some of the wide interspecific crosses which are dealt with here the simple monohybrid Mendelian scheme breaks down. Sometimes different types of seeds occur in the same capsule. As the characters are those of the testa this must involve a kind of somatic differentiation. How far this is the result of introducing a genom into cytoplasm strange to it (through crossing between species having different and not overlapping geographical ranges) remains an open question.

10. Capsules throughout are all of *S. maritima* type.

11. Sterility was marked or considerable in N. 162 and all F_2 families, except N. 168 and N. 176.

X. Crosses involving S. glareosa and S. vulgaris.

N. 208=*S. glareosa* K. 1094 plant 20 x *S. vulgaris* N. 12 plant 219. 46 plants in the family. Under controlled pollination 11 flowers produced 536 seeds.

Habit : centre loose, subprostrate, ends ascending subspreading ; all died down ; stems up to 7·3 dm.

Surface : all glabrous ; all mat.

Leaves : intermediate.

Anthocyanin in vegetative parts : medium 42 : little 4.

Inflorescence : number of flowers 11/1, 14/1, 15/1, 16/3, 18/1, 19/2, 21/3, 22/6, 23/4, 24/3, 25/3, 27/3, 28/2, 29/3, 31/1, 33/1, 35/3, 37/2, 39/1, 40/1.

Calyx : inflated 13 : subinflated 33 ; anthocyanin medium 46.

Corolla : W 27 : X 19 ; petals bilobed 46 ; 3/4-lobing 46 ; boss 16 : small scale 29 : scale 1 ; anthocyanin blotch present 4 : absent 39 ; petals and segments not overlapping.

Sex : hermaphrodite 13 : female 31.

Androecium : filaments and anthers purple 13.

Gynoecium : stigmata purple 44 ; immature seeds purple 44.

Capsules : hybrid type 33 : mixtures of *S. maritima*, *S. vulgaris*, and hybrid types 13.

Mature seeds : armadillo 26 : mixtures of armadillo, weak armadillo, and weak tubercled 13.

Sterility : not marked.

K. 1094 plant 20 : glabrous, medium anthocyanin in vegetative parts, little in calyx, calyx subinflated, petals X bilobed 3/4-lobing small scale blotch absent not overlapping, segments not overlapping, female, stigmata and immature seeds purple, capsules *S. maritima* type, seeds armadillo.

N. 12 plant 219 : anthocyanin in vegetative parts and calyx, few hairs, calyx subinflated, petals W bilobed 3/4-lobing boss blotch absent not overlapping, segments not overlapping, hermaphrodite, filaments white, anthers purple, stigmata white, immature seeds purple, capsules *S. vulgaris* type, seeds weak armadillo. (See *K.B.* 1931, p. 348).

N. 196=N. 12 plant 219 x K. 1095 plant 14. 67 plants in the family. Under controlled selfing 4 flowers gave 170 seeds.

Habit : centre subcompact, branches subspreading and suberect ; all died down in the winter ; stems up to 5·4 dm.

Surface : all glabrous ; all mat.

Leaves : intermediate but verging to K. 1095 plant 14, uniform.

Anthocyanin in vegetative parts : medium 67.

Inflorescence : up to 15 flowers.

Calyx : inflated 2 : subinflated 65 ; anthocyanin medium 67.

Corolla : W 46 : X 16 : Y 5 ; bilobed 67 ; 3/4-lobing 67 ; boss 67 ; anthocyanin blotch present 24 : absent 43 ; petals and segments not overlapping 67.

Sex : hermaphrodite 51 : female 16.

Androecium : filaments and anthers purple 51.

Gynoecium : stigmata purple and immature seeds purple 67.

Capsules : *S. maritima* type 3 : hybrid type 64.

Seeds : weak tubercled 9 : weak armadillo 19 : armadillo 39.
No sterility.

N. 196 plant 7 had calyx subinflated, petals W, blotch absent, hermaphrodite flowers, capsules of hybrid type, seeds armadillo.

N. 196 plant 2 had calyx inflated, petals X, blotch present, hermaphrodite flowers, capsules of hybrid type, seeds weak armadillo.

N. 350=N. 196 plant 7 selfed. 21 plants in the family.

Habit : stems up to 4·5 dm.

Anthocyanin in vegetative parts : medium 20 : little 1.

Surface : all glabrous (except No. 18 with few hairs on stems).

Leaves : F_1 type 5 : *S. glareosa* type 9 : smaller and narrower than grandparents 5. No plant had leaves verging from F_1 type towards the *S. vulgaris* grandparent. On the other hand, 5 plants had smaller and narrower leaves than the *S. glareosa* grandparent.

Inflorescence : number of flowers 2/1, 3/1, 5/1, 7/10, 9/1, 13/1.

Calyx : subinflated 16 ; anthocyanin medium 3 : little 13.

Corolla : W 13 ; petals bilobed 13, 3/4-lobing 13, boss 13, blotch absent 13, petals and segments not overlapping 13.

Sex : hermaphrodite 8 : hermaphrodite and female 5.

Androecium : filaments purple 10 : white 3 ; anthers purple 12 : yellow-green 1.

Gynoecium : stigmata purple 10 : white 4 ; immature seeds purple 11 : white 2.

Capsules : *S. maritima* type 6 : hybrid type 4 : *S. vulgaris* type 1.

Seeds : armadillo 11.
Sterility very marked.

N. 358=N. 196 plant 2 selfed. 19 plants in the family.

Habit : stems up to 5·0 dm.

Anthocyanin in vegetative parts : much 6 : medium 13.

Surface : all glabrous.

Leaves : F_1 type 3 : *S. glareosa* type 8 : smaller and narrower 7 : verging from F_1 a little towards *S. vulgaris* 1.

Inflorescence : number of flowers 3/3, 5/1, 6/1, 7/4, 9/2, 12/2, 15/1.

Calyx : subinflated 14 ; anthocyanin medium 5 : little 9.

Corolla : W 8 : X 5 : Y 1 ; petals bilobed 14, 3/4-lobing 14, boss 14, blotch present 4 : absent 10, petals and segments not overlapping 14.

Sex : hermaphrodite 11 : female 3.

Androecium : filaments purple 8 : white 3 ; anthers purple 11.

Gynoecium : stigmata purple 9 : white 4 ; immature seeds purple 10.

Capsules : *S. maritima* type 1 : F_1 type 10 : *S. vulgaris* type 1.

Seeds : weak armadillo 6 : armadillo 7.

Sterility very marked.

N. 174=N. 12 plant 219 x K. 1094 plant 52. 52 plants in the family.

Habit : centre subcompact, branches suberect ; all died down in winter ; stems up to 9·5 dm.

Surface : all glabrous ; all mat.

Leaves : intermediate, but verging towards K. 1094 plant 52.

Anthocyanin in vegetative parts : much 52.

Inflorescence : number of flowers 10/1, 11/1, 12/1, 13/12, 15/11, 16/1, 17/3, 18/3, 19/3, 21/5, 22/3, 23/2, 25/4, 26/1, 31/1.

Calyx : subinflated 52 ; anthocyanin little 52.

Corolla : W 13 : X 22 : Z 2 ; petals bilobed 37 ; 3/4-lobing 37 ; small scale 18 : boss 19 ; anthocyanin blotch present 3 ; absent 10 ; petals overlapping 23 : not overlapping 14 ; segments not overlapping 37.

Sex : hermaphrodite 31 : female 5.

Androecium : filaments and anthers purple 31.

Gynoecium : stigmata purple 30 : white 7 ; immature seeds purple 52.

Capsules : *S. maritima* type 8 : hybrid type 44.

Seeds : tubercled 9 : weak tubercled 6 : weak armadillo 17 : armadillo 20.

No sterility with open pollination.

With controlled self-pollination :

N. 174 plant	Total seeds	Capsules in which seeds contained	Average per capsule
22	146	10	14·6

N. 174 plant 1 had petals W, small scale, blotch present, petals overlapping, hermaphrodite flowers, stigmata purple, capsules of hybrid type, seeds weak armadillo.

N. 174 plant 52 had petals X, small scale, petals not overlapping, hermaphrodite flowers, stigmata purple, capsules of hybrid type, seeds armadillo.

N. 174 plant 22 had capsules of *S. maritima* type, seeds weak armadillo.

N. 357=N. 174 plant 1 selfed. 39 plants in the family.

Habit : centre subcompact, stems nearly erect or slightly ascending ; stems up to 4·5 dm.

Anthocyanin in vegetative parts : all medium.

Surface : all glabrous ; mat 33 : shining green 6.

Leaves : ranging from F_1 type to *S. glareosa* type.

Inflorescence : number of flowers up to 18.

Calyx : all subinflated ; anthocyanin medium 12 : little 25. No. 13 had a very small calyx.

Corolla : W 37 ; petals bilobed 37, 3/4-lobing 37, small scale 8 : boss 29, blotch present 1 : absent 36, petals and segments not overlapping 37.

Sex : hermaphrodite 20 : female 17.

Androecium : filaments purple 17 : white 3 ; anthers purple 20.

Gynoecium : stigmata purple 24 : white 13 ; immature seeds purple 7 : white 17.

Capsules : *S. maritima* type 2 : hybrid type 19.

Seeds : weak armadillo 16 : armadillo 12.

Very marked sterility.

N. 362=N. 174 plant 52 selfed. 16 plants in the family.

Habit : centre compact 2 : subcompact 9 : loose 5 ; branches erect 2 : suberect 5 : subprostrate 9 ; stems up to 4·5 dm.

Anthocyanin in vegetative parts : much 5 : medium 10 : little 1.

Indumentum : all glabrous ; mat 12 : shining green 4.

Leaves : *S. glareosa* type 7 : F_1 type 9.

Inflorescence : number of flowers 3/2, 7/7, 9/4, 11/1, 13/1, 17/1.

Calyx : subinflated 16 ; anthocyanin medium 2 : little 14.

Corolla : W 6 : X 3 : Y 6 : Z 1 ; petals bilobed 16, 3/4-lobing 15 : 2/3-lobing 1, boss 16, blotch present 4 : absent 12, petals and segments not overlapping 16.

Sex : hermaphrodite 13 : female 3.

Androecium : filaments purple 7 : white 5 ; anthers purple 10 : yellow-green 2.

Gynoecium : stigmata purple 6 : white 10 ; immature seeds purple 6 : white 4.

Capsules : hybrid type 5 : *S. vulgaris* type 4.

Seeds : armadillo 15.

Sterility very marked.

N. 367=N. 174 plant 22 selfed. 3 plants in the family.

Habit : centre subcompact 2 : loose 1 ; branches ascending 2 : prostrate 1 ; stems up to 4·0 dm.

Anthocyanin in vegetative parts : medium 2 : little 1.

Surface : glabrous 3 ; mat 3.

Leaves : F_1 type 3.

Inflorescence : number of flowers 3/1, 7/1, 11/1.

Calyx : inflated 1 : subinflated 2 ; anthocyanin medium 1 : little 2.

Corolla : X 2 : Y 1 ; petals bilobed 3, 3/4-lobing 3, boss 3, blotch present 1 : absent 2, petals and segments not overlapping 3.

Sex : female 3.

Gynoecium : stigmata purple 3.

Capsules : *S. maritima* type 1.

Seeds : weak armadillo 2.

Sterility very marked.

N. 171=*S. glareosa* K. 1094 plant 11 x *S. vulgaris* N. 37 plant 3. 35 plants in the family.

Habit : centre subcompact, branches suberect; all died down in winter ; stems up to 5·7 dm.

Surface : stems medium 8 : few 9 : glabrous 18 ; leaves dense 8 : medium 14 : few 6 : glabrous 7 ; all mat.

Leaves : intermediate and uniform.

Anthocyanin in vegetative parts : much 1 : medium 27 : little 6.

Inflorescence : Up to 20 flowers.

Calyx : inflated 2 : subinflated 33 ; anthocyanin medium 28 : little 7.

Corolla : W 30 : X 5 ; bilobed 35 ; 3/4-lobing 35 ; boss 35 ; anthocyanin blotch present 4 : absent 31 ; petals and segments not overlapping 35.

Sex : hermaphrodite 21 : hermaphrodite and female 1 : female 13.

Androecium : filaments and anthers purple 22.

Gynoecium : stigmata purple 35 ; immature seeds purple 29 : white 6.

Capsules : *S. maritima* type 6 : hybrid type 26 : *S. vulgaris* type 2.

Seeds : tubercled 19 : tubercled and weak tubercled 3 : weak tubercled and weak armadillo 13.

Sterility patchy with open pollination.

With controlled self-pollination :

N. 171 plant	Total seeds	Capsules in which seeds contained	Average per capsule
7	156	54	2·89

N. 37 plant 3 had little anthocyanin in the vegetative parts which were mat, dense indumentum, inflated calyx with little anthocyanin, petals white bilobed 3/4-lobing no blotch boss petals and segments not overlapping, hermaphrodite flowers, filaments and anthers purple, stigmata white, immature seeds purple, capsules *S. vulgaris* type, seeds tubercled.

N. 171 plant 7 had stems glabrous leaves few hairs, anthocyanin in vegetative parts medium, calyx subinflated with medium anthocyanin, petals X, blotch present, hermaphrodite flowers, immature seeds purple, capsules of hybrid type, seeds weak tubercled and weak armadillo.

N. 171 plant 8 had indumentum on stems and leaves medium, anthocyanin in vegetative parts little, calyx inflated with little anthocyanin, petals W, blotch absent, hermaphrodite flowers, immature seeds purple, capsules of hybrid type, seeds tubercled.

N. 344=N. 171 plant 7 selfed. 24 plants in the family.

Habit : subcompact 23 : loose 1, branches ascending 6 : suberect 18 ; stems up to 6·0 dm.

Anthocyanin in vegetative parts : much 1 : medium 21 : little 2.

Surface : stems medium 1 : few 2 : glabrous 21 ; leaves medium 2 : few 2 : glabrous 20 ; all mat.

Leaves : F_1 type 5 : *S. glareosa* type 17 : narrower 1 : verging from F_1 towards *S. vulgaris* 1.

Inflorescence : number of flowers 3/2, 5/2, 7/9, 10/1, 12/2, 13/3, 14/1, 15/1, 18/1, 19/1.

Calyx : subinflated 23 ; anthocyanin medium 11 : little 12.

Corolla : W 16 : X 6 ; petals bilobed 23, 3/4-lobing 23, boss 23, blotch absent 23, petals and segments not overlapping.

Sex : hermaphrodite 17 : hermaphrodite and female 1 : female 5.

Androecium : filaments purple 14 : white 4 ; anthers purple 18.

Gynoecium : stigmata purple 17 : white 6 ; immature seeds white 17.

Capsules : *S. maritima* type 2 : hybrid type 12.

Seeds : tubercled 2 : weak tubercled 1 : weak tubercled to weak armadillo 5 : weak armadillo 7.

Sterility very marked.

N. 349=N. 171 plant 8 selfed. 7 plants in the family.

Habit : centre compact 1 : loose 6, branches suberect 4 : subprostrate 3 ; stems up to to 5·0 dm.

Anthocyanin in vegetative parts : much 2 : medium 5.

Surface : stems medium 3 : few 1 : glabrous 3 ; leaves dense 2 : medium 1 : few 2 : glabrous 2 ; all mat.

Leaves : F_1 type 4 : *S. glareosa* type 3.

Inflorescence : number of flowers 5/1, 6/1, 7/2, 8/1, 9/1, 18/1.

Calyx : subinflated 6 ; anthocyanin little 6 : none 1.

Corolla : W 6 : Marguerite Yellow 1 ; petals bilobed 7, 3/4-lobing 7, boss 7, blotch absent 7, petals and segments not overlapping 7.

Sex : hermaphrodite 4 : female 3.

Androecium : filaments purple 4 ; anthers purple 3 : yellow-green 1.

Gynoecium : stigmata purple 5 : white 2 ; immature seeds white 1.

Capsules : hybrid type 3.

Seeds : weak tubercled 3.

Very great sterility.

The families dealt with in this section are :

N. 208=K. 1094 plant 20 x N. 12 plant 219.

N. 196=N. 12 plant 219 x K. 1095 plant 14.

N. 350=N. 196 plant 7 selfed.

N. 358=N. 196 plant 2 selfed.

N. 174=N. 12 plant 219 x K. 1094 plant 52.

N. 357=N. 174 plant 1 selfed.

N. 362=N. 174 plant 52 selfed.

N. 367=N. 174 plant 22 selfed.

N. 171=K. 1094 plant 11 x N. 37 plant 3.

N. 344=N. 171 plant 7 selfed.

N. 349=N. 171 plant 8 selfed.

In the results, points to be particularly noted are :

1. All plants scored in the winter had died down completely.

2. Hairs occurred in N. 171 by genes introduced from N. 37 plant 3 with dense indumentum. There was segregation for presence and absence of hairs and for degree of density when present in both F_1 and F_2 families for both stems and leaves.

3. N. 12 plant 219 was heterozygous for the genes giving mat or shining green surface. K. 1094 plant 52 was homozygous for mat surface. The F_1 was, therefore, all mat and two F_2 families segregated for mat and shining green surface in a summated ratio of 4·5 : 1.

4. Leaf shape in F_1 families was intermediate and F_2 families showed segregation.

5. Number of flowers were from 2 to 40 with very considerable ranges in both F_1 and F_2 families. *S. glareosa* very considerably reduces the number of flowers per inflorescence in crosses with *S. vulgaris*.

6. All F_1 families originated from crosses between coloured and white parents and all segregated for petal colour. All F_2 families from white F_1 plants bred true to white flowers and all from coloured F_1 plants segregated.

7. *Sex.*

N. 208	F x H
F_1	H 13 : F 31
N.196	H x H
F_1	H 51 : F 16
F_2	H 8 : HF 5
F_2	H 11 : F 3
N. 174	H x H
F_1	H 31 : F 5
F_2	H 20 : F 17
F_2	H 13 : F 3
F_2	F 3
N. 171	HF x H
F_1	H 21 : HF 1 : F 13
F_2	H 17 : HF 1 : F 5
F_2	H 4 : F 3

8. *Capsules*. There was segregation for capsule type in all families except N. 367 and N. 349.

9. *Seeds*. The only plants to breed true were two F_1 plants with armadillo seeds and one F_1 plant with weak armadillo seeds. All other families segregated with many, and sometimes fluctuating, character variations.

10. Sterility was not marked in F_1 families, except in some individuals in N. 171, but was more or less marked in F_2 families.

xi. Silene alpina x S. vulgaris and reciprocal.

N. 177=*S. vulgaris* N. 12 plant 219 x *S. alpina* K. 1091 plant 4. 6 plants in the family.

Habit : centre subcompact, branches prostrate and spreading ; died down in winter ; stems up to 4·6 dm.

Anthocyanin in vegetative parts : much 5 : little 1.

Indumentum : stems dense 5 : medium 1 ; leaves dense 6. The hairs are sub-bristly and longer than in K. 1091 plant 4.

Leaves : intermediate.

Inflorescence : flowers up to 15.

Calyx : inflated 2 : subinflated 4 ; anthocyanin medium 6.

Corolla : W 6 ; bilobed 6 ; 3/4-lobing 6 ; boss 2 : small scale 4 ; anthocyanin blotch present 1 : absent 5 ; petals and segments not overlapping 6.

Sex : hermaphrodite 6.

Androecium : filaments and anthers purple 6.

Gynoecium : stigmata and immature seeds purple 6.

Capsules : *S. maritima* type 1 : hybrid type 5.
Seeds : armadillo 6.

N. 177 plant 3 had indumentum on stems medium, anthocyanin in vegetative parts much, calyx subinflated, small scale, blotch absent, capsule of hybrid type.

N. 352=N. 177 plant 3 selfed. 4 plants in the family.

Habit : centre compact 1 : subcompact 1 : loose 2 ; branches erect 1 : suberect 2 : prostrate 1 ; stems up to 4·3 dm.

Anthocyanin in vegetative parts : medium 4.

Indumentum : stems and leaves medium 3 : glabrous 1.

Leaves : *S. alpina* type 1 : F_1 type 3.

Inflorescence : number of flowers : 2/4, 1/5, 1/11.

Calyx : inflated 1 : subinflated 3 ; anthocyanin medium 2 : little 2.

Corolla : W 4 ; petals bilobed 4, 3/4-lobing 4, boss 4, blotch absent 4, petals and segments not overlapping.

Sex : hermaphrodite 4.

Androecium : filaments purple 1 : white 3 ; anthers purple 4.

Gynoecium : stigmata purple 1 : white 3 ; immature seeds purple 1.

Capsules : *S. vulgaris* type 1.

Seeds : armadillo 1.

Sterility very marked.

N. 191=*S. alpina* K. 1085 plant 57 x *S. vulgaris* N. 12 plant 219. Under controlled pollination no viable seed was set.

N. 192=*S. alpina* K. 1085 plant 5 x *S. vulgaris* N. 37 plant 3. Under controlled pollination this cross gave no viable seed.

N. 197=*S. vulgaris* N. 12 plant 219 x *S. alpina* K. 1085 plant 48. 57 plants in the family. Under controlled selfing 9 flowers gave 309 seeds.

Habit : centre subcompact, branches spreading and ascending ; all died down in winter ; stems up to 5·5 dm.

Anthocyanin in vegetative parts : much 57.

Indumentum : stems medium 4 : few 7 : glabrous 46 ; leaves medium 8 : few 5 : glabrous 44.

Leaves : intermediate and uniform.

Inflorescence : number of flowers 7/5, 9/5, 10/4, 11/8, 12/4, 13/17, 15/6, 17/6, 18/1, 19/1.

Calyx : subinflated 48 ; anthocyanin much 48.

Corolla : W 28 : X 19 : Z 1 ; petals bilobed 48 ; 3/4-lobing 48 ; small scale 29 : boss 19 ; anthocyanin blotch not present 28 ; petals overlapping 33 : not overlapping 15 ; segments overlapping 15 : not overlapping 33.

Sex : hermaphrodite 39 : hermaphrodite and female 1 : female 8.

Androecium : filaments and anthers purple 40.

Gynoecium : stigmata purple 51 ; immature seeds purple 57.

Capsules : *S. maritima* type 5 : hybrid type 51.

Seeds : weak tubercled 2 : weak armadillo 16 : armadillo 38.

No obvious sterility.

N. 197 plant 9 had indumentum stems and leaves medium, petals W, small scale, petals and segments overlapping, hermaphrodite flowers, capsules of hybrid type, seeds weak armadillo.

N. 197 plant 8 had indumentum stems few, leaves medium, petals W, boss, petals overlapping, segments not overlapping, hermaphrodite flowers, capsules *S. maritima* type, seeds armadillo.

N. 197 plant 27 had petals X, small scale, petals not overlapping, segments overlapping, hermaphrodite flowers, capsules of hybrid type, seeds weak armadillo.

N. 359=N. 197 plant 9 selfed. 1 plant in the family.

This single small plant, with stems up to 1·7 dm., did not flower. It had much anthocyanin in the vegetative parts ; indumentum medium on leaves, stems glabrous, and leaf-shape as the *S. alpina* grandparent.

N. 363=N. 197 plant 8 selfed. 2 plants in the family.

Habit : centre loose, stems subprostrate ; up to 2·7 dm.

Anthocyanin in vegetative parts : much 1 : medium 1.

Indumentum : stems few 1 : glabrous 1 ; leaves medium 1 : glabrous 1.

Leaves ; F_1 type 1 : verging towards the *S. alpina* grandparent 1.

Inflorescence : number of flowers : up to 7.

Calyx : subinflated 2 ; anthocyanin medium 2.

Corolla : W 2 ; petals bilobed 2, 3/4-lobing 2, boss 2, blotch absent 2, petals and segments not overlapping 2.

Sex : hermaphrodite 2.

Androecium : filaments white 2 ; anthers purple 2.

Gynoecium : stigmata white 2 ; immature seeds purple 2.

Capsules : *S. maritima* type 1.

Seeds : armadillo 1.

N. 354=N. 197 plant 27 selfed. 12 plants in the family.

Habit : centre subcompact, branches erect to slightly ascending ; stems from 2·0 dm. to 6·7 dm.

Anthocyanin in vegetative parts : much 1 : medium 11.

Indumentum : stems few hairs 4 : glabrous 8 ; leaves medium 4 : glabrous 8 ; shining green 2 : mat 10.

Leaves : verging towards *S, vulgaris* grandparent 1 : F_1 type 8 : verging slightly towards *S. alpina* grandparent 2 : rather more so 1.

Inflorescence : number of flowers 2/1, 3/1, 5/2, 7/5, 9/1, 11/1, 25/1.

Calyx : subinflated 12 ; anthocyanin medium 9 : little 3.

Corolla : W 7 : X 5 ; petals bilobed 11, 3/4-lobing 11, boss 11, blotch present 3 : absent 8, petals and segments not overlapping 11.

Sex : hermaphrodite 10 : female 1.

Androecium : filaments purple 9 : white 1 ; anthers purple 10.

Gynoecium : stigmata purple 8 : white 3 ; immature seeds purple 5 : white 3.

Capsules : hybrid type 5.

Seeds : weak tubercled 1 : weak armadillo 3 : armadillo 1.
Very great sterility.

N. 184=*S. alpina* K. 1085 plant 15 x *S. vulgaris* N. 12 plant 219. 37 plants in the family. Under controlled pollination 3 flowers gave 228 seeds.

Habit : centre compact, flowering branches subspreading and ascending ; all died down in winter ; stems up to 4 dm.

Indumentum : short and bristly. Stems few 5 : glabrous 32 ; leaves dense 5 : medium 1 : few 3 : glabrous 28.

Leaves : intermediate but verging towards N. 12 plant 219.

Anthocyanin in vegetative parts : much 1 : medium 26.

Inflorescence : up to 16 flowers.

Calyx : inflated 22 : subinflated 15 ; anthocyanin medium 37.

Corolla : W 25 : X 12 ; petals bilobed 37 ; 3/4-lobing 37 ; boss 37 ; anthocyanin blotch present 1 : absent 36 ; petals not overlapping 37 ; segments overlapping 6 : not overlapping 23.

Sex : hermaphrodite 10 : female 27.

Androecium : filaments and anthers purple 10.

Gynoecium : stigmata purple 37 ; immature seeds purple 37.

Capsules : *S. maritima* type 15 : hybrid type 22.

Seeds : weak armadillo 11 : armadillo 26.

No sterility in open pollination.

N. 184 plant 12 had glabrous stems and leaves, anthocyanin in vegetative parts medium, calyx inflated, petals W, blotch absent, segments not overlapping, hermaphrodite flowers, capsules of hybrid type, seeds armadillo.

N. 366=N. 184 plant 12 selfed. 3 plants in the family.

Habit : stems up to 3·0 dm.

Anthocyanin in vegetative parts : much 2 : medium 1.

Indumentum : few, very short hairs 1 : glabrous 2.

Leaves : F_1 type 1 : *S. alpina* type 2.

Inflorescence : number of flowers 5/2.

Calyx : subinflated 3 ; anthocyanin medium 2 : little 1.

Corolla : W 2 ; petals bilobed 2, 3/4-lobing 2, boss 2, blotch absent 2, petals and segments not overlapping 2.

Sex : hermaphrodite 2.

Androecium : filaments purple 2 ; anthers purple 1.

Gynoecium : stigmata white 2 ; immature seeds white 1.

Capsules : none scorable.

Seeds : armadillo 1.

Almost complete sterility.

The families dealt with in this section are :

N. 177=N. 12 plant 219 x K. 1091 plant 4.

N. 352=N. 177 plant 3 selfed.

N. 197=N. 12 plant 219 x K. 1085 plant 48.

N. 359=N. 197 plant 9 selfed.

N. 363=N. 197 plant 8 selfed.

N. 354=N. 197 plant 27 selfed.

N. 184=K. 1085 plant 15 x N. 12 plant 119.

N. 366=N. 184 plant 12.

In the results, points to be particularly noted are :

1. All plants that could be scored in the second winter of their age died down.

2. All families segregated for indumentum characters.

3. Two shining green plants appeared in N. 354. The genes for this were introduced from N. 12 plant 219.

4. For leaf shapes, F_1 plants were intermediate and there was segregation in F_2 families.

5. Flower number was reduced by genes from *S. alpina*, but, in the larger families, there was a considerable range in both F_1 and F_2.

6. There was segregation for petal colour in two F_1 families and in one F_2 family.

7. *Sex.*

N.177.	H x H
F_1	H 6
F_2	H 4
N. 197.	H x H
F_1	H 39 : HF 1 : F 8
F_2	H 2
F_2	H 10 : F 1
N. 184.	F x H
F_1	H 10 : F 27
F_2	H 2

8. *Seeds.* N. 12 plant 219 had weak armadillo seeds. This modified type occurred in two F_1 families and in one F_2 family.

9. *Capsules.* There was segregation for capsule shape in all F_1 families.

10. *Sterility* was not obvious in two F_1 families but was very marked to almost complete in F_2 families.

xii. Silene vulgaris, S. glareosa, and S. alpina crossed with S. vulgaris (Norway).

N. 216=*S. vulgaris* N. 12 plant 219 x *S. vulgaris* (Norway) P. 1 plant 11. 23 plants in the family. Under controlled pollination 2 flowers produced 65 seeds.

Habit : centre subcompact, branches spreading and ascending ; died down in the winter ; stems up to 5·5 dm. ; glabrous.

Anthocyanin in vegetative parts : medium 23.

Leaves : very similar to P.1 plant 11.

Inflorescence : number of flowers up to 75.

Calyx : subinflated 23 ; anthocyanin medium 23.

Corolla : W 23 ; petals bilobed 23 ; 3/4-lobing 23 ; small scale 4 : boss 19 ; anthocyanin blotch absent 23 ; petals and segments not overlapping 23.

Sex : hermaphrodite 7 : female 16.

Androecium : filaments and anthers purple 7.

Gynoecium : stigmata purple 23 ; immature seeds purple 11 : white 12.

Capsules : intermediate between *S. maritima* and hybrid types 1 : hybrid type 12 : intermediate between *S. vulgaris* and hybrid types 8 : *S. vulgaris* type 2.

Seeds : tubercled to weak tubercled 2 : weak tubercled to weak armadillo 9 : weak tubercled to armadillo 1 : armadillo 11.

N. 216	Capsules	Seeds	Average per capsule
Plant 3 selfed	10	266	26·6
Plant 11 selfed	11	242	22·0

N. 216 plant 3 had boss, hermaphrodite flowers, immature seeds white, capsules of hybrid type, seeds armadillo.

N. 216 plant 11 had small scale, hermaphrodite flowers, immature seeds white, capsules intermediate between *S. vulgaris* and hybrid types, seeds weak tubercled to weak armadillo.

N. 216 plant 22 had boss, hermaphrodite flowers, immature seeds white, capsules intermediate between *S. vulgaris* and hybrid types, seeds armadillo.

P. 1 plant 11 had much anthocyanin in vegetative parts and calyx, glabrous , 17 flowers, subinflated calyx, petals white bilobed 3/4-lobing small scale anthocyanin blotch absent petals and segments not overlapping, zygomorphic hermaphrodite flowers, filaments anthers and stigmata purple, immature seeds white, capsules *S. maritima* type, seeds armadillo. P. 1 plant 11 was a plant grown from seed collected in Norway and was determined as *S. vulgaris* s.l., not equivalent to British *S. vulgaris* stocks in various characters. (see K.B. 1939, 466 for a full account).

N. 364=N. 216 plant 3 selfed. 34 plants in the family.

Habit : stems up to 6·0 dm.

Anthocyanin in vegetative parts : medium 20 : little 3.

Indumentum : all glabrous.

Leaves : F_1 type 33.

Inflorescence : number of flowers : up to 50.

Calyx : subinflated 33 ; anthocyanin medium 19 : little 14.

Corolla : W 33 ; petals bilobed 33, 3/4-lobing 33, boss 33, blotch absent 33, petals and segments not overlapping 33.

Sex : hermaphrodite 22 : hermaphrodite and female 2 : female 9.

Androecium : filaments purple 23 : white 1 ; anthers purple 23.

Gynoecium : stigmata purple 31 : white 2 ; immature seeds white 19.

Capsules : *S. vulgaris* type 6 : hybrid type 21.

Seeds : armadillo 29.

Sterility marked in some plants only.

N. 365=N. 216 plant 11 selfed. 22 plants in the family.

Habit : stems up to 7·0 dm.

Anthocyanin in vegetative parts : much 1 : medium 20.

Indumentum : all glabrous.

Leaves : F_1 type 18 : verging a little towards the British *S. vulgaris* grandparent 4.

Inflorescence : number of flowers up to 31.

Calyx : subinflated 21 ; anthocyanin medium 21.

Corolla : W 21 ; petals bilobed 21, 3/4-lobing 21, boss 21, blotch absent 21, petals and segments not overlapping 21.

Sex : hermaphrodite 14 : female 7.

Androecium : filaments and anthers purple 14.

Gynoecium : stigmata purple 2 : white 19 ; immature seeds white 14.

Capsules : *S. vulgaris* type 2 : hybrid type 13.

Seeds : tubercled 5 : weak tubercled 6 : weak armadillo 1 : armadillo 4.

Sterility marked in many plants.

N. 360=N. 216 plant 22 selfed. 31 plants in the family.

Habit : stems up to 6·0 dm.

Anthocyanin in vegetative parts : much 3 : medium 22 : little 6.

Indumentum : all glabrous.

Leaves : F_1 type 31 : verging slightly towards the *S. vulgaris* grandparent 1.

Inflorescence : number of flowers up to 46.

Calyx : subinflated 31 ; anthocyanin medium 31.

Corolla : W 31 ; petals bilobed 31, 3/4-lobing 31, boss 21, blotch absent 31, petals and segments not overlapping 31.

Sex : hermaphrodite 19 : female 12.

Androecium : filaments purple 17 : white 2 ; anthers purple 19.

Gynoecium : stigmata purple 12 : white 19 ; immature seeds white 22.

Capsules : *S. vulgaris* type 14 : hybrid type 8.

Seeds : armadillo 27.

Sterility marked in many plants.

Crosses involving S. vulgaris (Norway) and S. vulgaris (Britain).

The families dealt with in this subsection are :

N. 216=N. 12 plant 219 x P. 1 plant 11.

N. 364=N. 216 plant 3 selfed.

N. 365=N. 216 plant 11 selfed.

N. 360=N. 216 plant 22 selfed.

In the results, points to be particularly noted are :

1. The plants all died down in the winter and were all glabrous.

2. The flower number per inflorescence was high, maxima ranging from 31 to 75.

3. *Sex.*

N. 216	H x H
F_1	H 7 : F 16
F_2	H 22 : HF 2 : F 9
F_2	H 14 : F 7
F_2	H 19 : F 12

4. *Seeds.* Plants with armadillo seeds of F_1 families bred true to this character. Families involving an immediate parent with weak armadillo seeds segregated and in one F_2 family even tubercled seeds were recorded.

5. *Sterility* occurred in some plants of F_2 families.

N. 215=*S. glareosa* K. 1094 plant 20 x *S. vulgaris* (Norway) P. 1 plant 11. 21 plants in the family. Under controlled polliuation 6 flowers produced 281 seeds.

Habit : centre subcompact, branches spreading erect at ends ; all died down in winter ; stems up to 5·0 dm.

Surface : all glabrous, all mat.

Leaves : intermediate, but in length nearer to P. 1 plant 11 and in breadth to K. 1094 plant 20.

Anthocyanin in vegetative parts : much 2 : medium 12 : little 7.

Inflorescence : number of flowers 11/2, 12/3, 13/1, 14/3, 15/1, 16/1, 19/1, 20/2, 22/1, 23/1, 24/1, 25/1, 26/1, 28/1, 35/1.

Calyx : subinflated 21 ; anthocyanin much 2 : medium 19.

Corolla : W 11 : X 9 : Y 1 ; petals bilobed 21 ; 3/4-lobing 21 ; scale 6 : small scale 10 : boss 5 ; anthocyanin blotch present 1 : absent 20 ; petals and segments not overlapping.

Sex : hermaphrodite and female 1 : female 20.

Androecium : filaments and anthers purple 1.

Gynoecium : stigmata purple 21 ; immature seeds purple 21.

Capsules : *S. maritima* type 18 : hybrid type 3.

Seeds : tubercled 5 : tubercled to weak tubercled 11 : tubercled to weak armadillo 1 : weak tubercled to weak armadillo 4.

N. 218=*S. glareosa* K. 1099 plant 46 x *S. vulgaris* (Norway) P. 1 plant 11. 17 plants in the family. Under controlled pollination 7 flowers produced 154 seeds.

Habit : centre subcompact, branches spreading and ascending ; stems died down in winter ; stems up to 5·5 dm.

Indumentum : all glabrous.

Leaves : intermediate.

Anthocyanin in vegetative parts : medium 17.

Inflorescence : number of flowers up to 18.

Calyx : inflated 4 : subinflated 13 ; anthocyanin medium 17.

Corolla : W 5 : X 12 ; petals bilobed 17 ; 3/4-lobing 17 ; small scale 5 : boss 12, anthocyanin blotch present 13 : absent 3 ; petals and segments not overlapping.

Sex : hermaphrodite 8 : female 9.

Androecium : filaments and anthers purple 8.

Gynoecium : stigmata purple 17 ; immature seeds purple 8 : white 9.

Capsules : *S. maritima* type 17.

Seeds : armadillo 17.

With open pollination no marked sterility.

N. 218 plant 13 had calyx subinflated, petals X, boss, blotch present, hermaphrodite flowers, immature seeds white.

N. 218 plant 11 had calyx inflated, petals W, small scale, blotch absent, hermaphrodite flowers, immature seeds white.

N. 218 plant 3 had calyx inflated, petals W, small scale, blotch present, hermaphrodite flowers, immature seeds purple.

N. 347=N. 218 plant 13 selfed. 44 plants in the family.

Habit : centre subcompact and branches suberect ; stems up to 4·5 dm.

Anthocyanin in vegetative parts : much 3 : medium 32 : little 7.

Indumentum : glabrous.

Leaves : F_1 type 5 : *S. glareosa* type 30 : smaller and narrower 5 : verging from F_1 type towards *S. vulgaris* 3.

Inflorescence : number of flowers. 3/2, 4/1, 5/2, 6/3, 7/12, 8/3, 9/5, 10/3, 11/1, 12/2, 13/1, 14/3, 16/1, 17/2, 20/1, 25/1.

Calyx : subinflated 42 ; anthocyanin medium 42, none 1.

Corolla : W 6 : X 7 : Y 18 : Z 11 ; petals bilobed 42, 3/4-lobing 42, small scale 1 : boss 41, blotch present 27 : absent 15, petals and segments not overlapping 42.

Sex : hermaphrodite 33 : female 9.

Androecium : filaments and anthers purple 3.

Gynoecium : stigmata purple 39 : white 3 ; immature seeds white 23.

Capsules : *S. maritima* type 17.

Seeds : armadillo 32.

Sterility very marked.

N. 348=N. 218 plant 11 selfed. 4 plants in the family.

Habit : centre subcompact 1 : loose 3, branches ascending 4 ; stems up to 4·0 dm.

Anthocyanin in vegetative parts : medium 3 : little 1.

Indumentum : all glabrous.

Leaves : all *S. glareosa* type.

Inflorescence : number of flowers 10/2, 14/2.

Calyx : subinflated 4 ; anthocyanin much 3 : medium 1.

Corolla : W 4 ; petals bilobed 4, 3/4-lobing 4, boss 4, blotch absent 4, petals and segments not overlapping 4.

Sex : hermaphrodite 4.

Androecium : filaments and anthers purple 4.

Gynoecium : stigmata purple 4.

Capsules : none scorable.

Seeds : armadillo 1.

Almost complete sterility.

N. 345=N. 218 plant 3 selfed. 13 plants in the family.

Habit : centre loose 13, branches subprostrate 13 ; stems up to 6·0 dm.

Anthocyanin in vegetative parts : much 1 : medium 11 : little 1.

Indumentum : all glabrous.

Leaves : F_1 type 3 : *S. glareosa* type 9.

Inflorescence : number of flowers 7/2, 8/4, 9/2, 10/1, 12/1, 14/1, 55/1.

Calyx : subinflated 13 ; anthocyanin medium 12 : little 1.

Corolla : W 13 ; petals bilobed 13, 3/4-lobing 12 : 2/3-lobing 1, small scale 4 : boss 9, blotch present 4 : absent 9, petals and segments not overlapping 13.

Sex : hermaphrodite 12 : female 1.

Androecium : filaments and anthers purple 12.

Gynoecium : stigmata purple 12 : white 1 ; immature seeds purple 1.

Capsules : *S. maritima* type 12.

Seeds : armadillo 12.

Sterility marked.

Crosses involving S. vulgaris (Norway) and S. glareosa.

The families dealt with in this subsection are :

N. 215=K. 1094 plant 20 x P. 1 plant 11.

N. 218=K. 1099 plant 46 x P. 1 plant 11.

N. 347=N. 218 plant 13 selfed.

N. 348=N. 218 plant 11 selfed.

N. 345=N. 218 plant 3 selfed.

In the results, points to be particularly noted are :

1. The plants all died down in the winter and were glabrous.

2. The flower number per inflorescence showed a very great range from 11 to 35 in F_1 and 3 to 55 in F_2 families. The maximum in N. 345 greatly exceeded the maximum for either grandparent.

3. Families where one parent had coloured flowers segregated for colour. White flowered plants bred true on selfing for this character.

4. *Sex.*		F x H
	F_1	HF 1 : F 20
		H x H
	F_1	H 8 : F 9
	F_2	H 33 : F 9
	F_2	H 4
	F_2	H 12 : F 1

5. Plants with armadillo seeds bred true to this character on crossing and selfing. When a plant with weak tubercled to weak armadillo seeds was fertilized by pollen from a plant with armadillo seeds there was complex segregation.

6. Sterility was marked to almost complete in F_2 families.

N. 217=*S. alpina* K. 1085 plant 57 x *S. vulgaris* (Norway) P. 1 plant 11. 4 plants in the family. Under controlled pollination 6 flowers produced 26 seeds.

Habit : centre rather compact, branches spreading and ascending ; stems up to 3·4 dm.

Surface : all glabrous, all mat.

Leaves : intermediate, but verging to P. 1 plant 11.

Anthocyanin in vegetative parts : medium 3 : little 1.

Inflorescence: number of flowers up to 11.

Calyx : subinflated 4 ; anthocyanin much 1 : medium 3.

Corolla : W 2 : X 2 ; petals bilobed 4 ; 3/4-lobing 4 ; boss 4 ; anthocyanin blotch absent ; petals not overlapping 4 ; segments overlapping 1 : not overlapping 3.

Sex : hermaphrodite 1 : female 3.

Androecium : filaments and anthers purple 1.

Gynoecium : stigmata purple 4 ; immature seeds purple 4.

Capsules and seeds : not produced.

xiii. Selfing of and crosses involving S. glareosa from the Tyrol.

P. 9 plant 1. *S. glareosa.* Grown from seed collected in the Tyrol by Dr. C. D. Darlington.

Habit : centre subcompact, branches spreading and suberect ; died down in winter ; stems up to 3·5 dm.

Indumentum : short bristly, medium on stems and few on leaves.

Leaves : narrowly lanceolate, linear-lanceolate, to narrowly oblanceolate, acute, up to 3 cm. long and 0·8 cm. broad.

Anthocyanin in vegetative parts : little.

Inflorescence : flowers up to 9.

Calyx : subinflated ; anthocyanin medium.

Corolla : W ; petals bilobed ; 3/4-lobing ; boss ; anthocyanin blotch absent ; petals and segments not overlapping.

Sex : hermaphrodite.

Androecium : filaments and anthers purple.

Gynoecium : stigmata purple ; immature seeds white.

Capsules : *S. maritima* type.

Seeds : armadillo.

N. 206=P. 9 plant 1 selfed. 1 plant in the family. Under controlled selfing 15 flowers produced 315 seeds.

Habit : centre subcompact, branches spreading and suberect ; died down in winter ; stems up to 2·5 dm.

Indumentum : short bristly, medium on stems and few on leaves.

Leaves : as parent.

Anthocyanin in vegetative parts : little.

Inflorescence : up to 7 flowers.

Calyx : subinflated ; anthocyanin medium.

Corolla : W ; petals bilobed ; 3/4-lobing ; boss ; anthocyanin blotch absent ; petals and segments not overlapping.

Sex : hermaphrodite.

Androecium : filaments and anthers purple.

Gynoecium : stigmata purple ; immature seeds white.

Capsules : *S. maritima* type.

Seeds : armadillo.

N. 201=*S. glareosa* K. 1094 plant 11 x *S. glareosa* (Tyrol) P. 9 plant 1. 1 plant in the family. Under controlled pollination 5 flowers gave 232 seeds.

Habit : centre subcompact, branches spreading and suberect ; died down in winter ; stems up to 3·6 dm.

Indumentum : glabrous.

Leaves : as parents.

Anthocyanin in vegetative parts : medium.

Inflorescence : number of flowers 1 to 9, mostly 3.

Calyx : subinflated ; anthocyanin medium.

Corolla : X ; petals bilobed ; 3/4-lobing ; boss ; anthocyanin blotch absent ; petals and segments not overlapping.

Sex : female.

Gynoecium : stigmata purple ; immature seeds purple.

Capsules : *S. maritima* type.

Seeds : weak tubercled to weak armadillo.

N. 200=*S. vulgaris* N. 12 plant 219 x *S. glareosa* (Tyrol) P. 9 plant 1. 28 plants in the family. Under controlled pollination 6 flowers produced 224 seeds.

Habit : centre subcompact, branches spreading and ascending ; all died down in the winter ; stems up to 5·1 dm.

Indumentum : medium 2 : few 2 : glabrous 24.

Leaves : intermediate, but nearer to N. 12 plant 219.

Anthocyanin in vegetative parts : medium 13 : little 15.

Inflorescence : flowers up to 22.

Calyx : inflated 15 : subinflated 13 ; anthocyanin medium 28.

Corolla : W 28 ; petals bilobed 28 ; 3/4-lobing 28 ; boss 28 ; anthocyanin blotch absent 28 ; petals not overlapping 28 ; segments overlapping 3 : not overlapping 25.

Sex : hermaphrodite 18 : female 10.

Androecium : filaments purple 15 : white 3 ; anthers purple 18.

Gynoecium : stigmata purple 18 : white 9 ; immature seeds purple 13 : white 15.

Capsules : *S. maritima* type 11 : hybrid type 17.

Seeds : weak armadillo 7 : armadillo 21.

N. 205=K. 1085 plant 5 x P. 9 plant 1. 6 plants in the family. Under controlled pollination 3 flowers produced 114 seeds.

Habit : subcompact centre with subspreading branches ; died down in winter ; stems up to 3·0 dm.

Indumentum : stems medium 5 : few 1 ; leaves dense 3 : medium 1 : few 2.

Leaves : intermediate.

Anthocyanin in vegetative parts : medium 6.

Inflorescence : number of flowers 1 to 5.

Calyx : inflated 2 : subinflated 4 ; anthocyanin much 5.

Corolla : W 3 : X 3 ; petals bilobed 6 ; 3/4-lobing 6 ; boss 6 ; anthocyanin blotch absent 6 ; petals and segments not overlapping 6.

Sex : female 6.

Gynoecium : stigmata purple 6 ; immature seeds purple 6.

Capsules : *S. maritima* type 6.

Seeds : armadillo 6.

Selfing of and crosses involving S. glareosa (Tyrol).

Familes involved in this series are :

N. 206= 9 plant 1 (*S. glareosa*, Tyrol) selfed.

N. 201=K. 1094 plant 11 (*S. glareosa*, France) x P. 9 plant 1.

N. 200=N. 12 plant 219 (*S. vulgaris*, Britain) x P. 9 plant 1.

N. 205=K. 1085 plant 5 (*S. alpina*, France) x P. 9 plant 1.

In the results, points to be particularly noted are :

1. All plants died down in the winter.

2. With the introduction of *S. vulgaris* genes the number of flowers per inflorescence rises considerably.

3. *Sex.* P. 9 plant 1 was hermaphrodite (H). F_1 families

with HF x H gave F 1
with H x H gave H 18 : F 10.
with HF x H gave F 5.

4. Capsules were all of *S. maritima* type, except when *S. vulgaris* was the ovule parent when in F_1 there were *S. maritima* type 11 : hybrid type 17.

5. *Sterility.* This was very marked indeed in the selfing of P. 9 plant 1 and in crosses between this and either *S. glareosa* from France or *S. alpina* from France ; it was less marked when crossed with *S. vulgaris* from Britain. The sterility expressed itself in failure of seeds to germinate.

XIV. CROSSINGS INVOLVING A PLANT GROWN FROM SEED FROM AN S. GLAREOSA POPULATION AND HAVING ENTIRE AND ROUNDED TO EMARGINATE PETALS AND STAMINODES.

The original seed of K. 1099 came from eastern France near, St. Nizier, from plants growing on upper limestone screes in beech-conifer woods, 7.8.1931.

The families dealt with in this section are :

N. 146=K. 1099 plant 41 x S.P.A. 13 (*S. maritima*, Chesil Beach).

N. 274=N. 146 plant 18 selfed.

N. 275=N. 146 plant 15 selfed.

N. 276=N. 146 plant 24 selfed.

N. 147=K. 1099 plant 41 x S.P.A.70 (*S. maritima*, Chesil Beach).

N. 268=N. 147 plant 8 selfed.

N. 269=N. 147 plant 2 selfed.

N. 278=N. 147 plant 7 selfed.

N. 300=N. 147 plant 6 x N. 147 plant 7.

N. 271=N. 147 plant 6 x N. 104 plant 10 (*S. maritima* selfing, Chesil Beach).

N. 307=N. 147 plant 6 x N. 104 plant 11 (as last).

N. 148=K. 1099 plant 41 x S.P.A. 15 (*S. maritima*, narrow-leaved, Chesil Beach).

N. 272=N. 148 plant 37 selfed.

N. 273=N. 148 plant 47 selfed.

N. 282=N. 148 plant 59 selfed.

N. 283=N. 148 plant 57 selfed.

N. 320=N. 148 plant 52 selfed.

N. 149=K. 1099 plant 41 x N. 18 plant 11 (*S. maritima* selfed, Porlock).

N. 270=N. 149 plant 10 selfed.

N. 321=N. 149 plant 4 selfed.

N. 281=N. 149 plant 34 x N. 18 plant 11.

N. 291=N. 149 plant 4 x N. 18 plant 11.

N. 305=N. 149 plant 7 x N. 18 plant 11.

N. 303=N. 149 plant 10 x N. 156 plant 2 (*S. maritima*, selfing, selfed, Porlock).

N. 312=N. 149 plant 34 x N. 156 plant 2 (*S. maritima*, as above).

N. 315=N. 149 plant 7 x N. 148 plant 52 (see above).

N. 154=K. 1099 plant 41 x S.P.B. 37 (*S. vulgaris*, Loch Tay).

N. 277=N. 154 plant 25 selfed.

N. 299=N. 154 plant 23 x N. 154 plant 25.

N. 301=N. 154 plant 49 x N. 154 plant 25.

N. 304=N. 154 plant 28 x N. 154 plant 25.

N. 293=N. 154 plant 23 x N. 121 plant 3 (*S. vulgaris*, Loch Tay, selfing).

N. 294=N. 154 plant 27 x N. 121 plant 3.

N. 295=N. 154 plant 28 x N. 121 plant 3.

N. 155=K. 1099 plant 41 x N. 12 plant 251 (*S. vulgaris*. selfing, Potterne Field).

N. 290=N. 155 plant 30 selfed.

N. 310=N. 155 plant 36 selfed.

N. 298=N. 155 plant 1 x N. 155 plant 30.

N. 309=N. 155 plant 1 x N. 155 plant 36.

K. 1099 plant 41. *S. glareosa* emarginate variant.

Habit : stems spreading, subprostrate in flower with ends just ascending, up to 6·3 dm. in length, with medium anthocyanin in the vegetative parts, glabrous, mat. Complete dying down in the winter.

Leaves : narrowly elliptic or elliptic-oblanceolate, slightly acuminate, 3·3 cm. long and 1·4 cm. broad (average), green, mat.

Inflorescence : with up to 14 flowers ; bracts acuminate, lower green-herbaceous, upper scarious, eciliate.

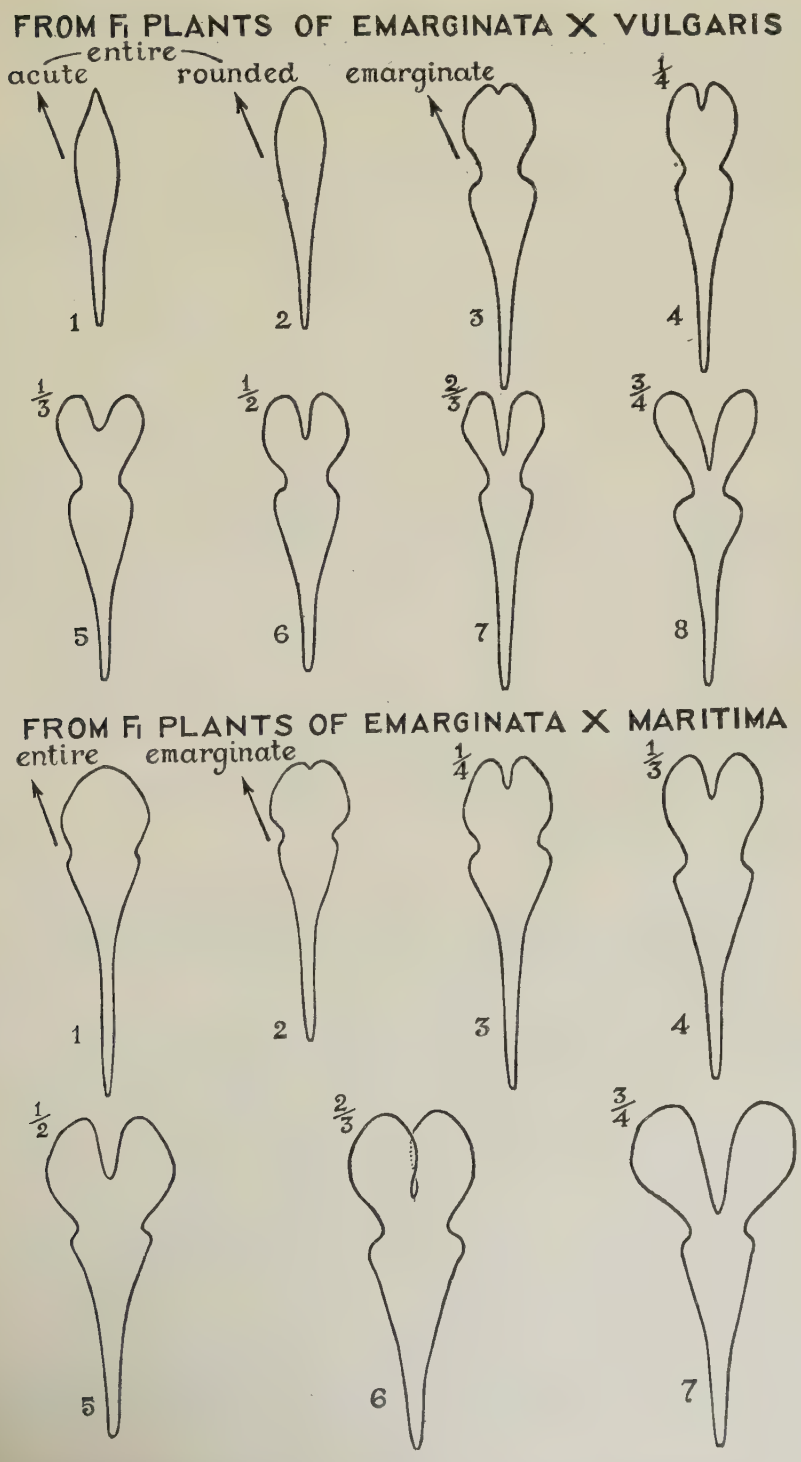
Calyx : subinflated, with medium anthocyanin.

Corolla : with petals Marguerite Yellow (Ridgway, Color Standards Plate XXX.), narrowly oblanceolate, 1·4 cm. long, 0·3 cm. broad, entire and rounded to emarginate, little or no trace of a boss, anthocyanin blotch absent, petals not overlapping.

Sex : female, constant for life of 5 years.

Androecium : with stamens represented by 10 petaloid staminodes which are narrowly oblanceolate-linear subacute 1·3 cm. long 0·15 cm. broad.

Gynoecium : stigmata purple ; immature seeds white.



Series of petals to show range from entire to 3/4-lobing. Top series from the cross *S. glareosa* emarginate variant x *S. vulgaris*. Bottom series from the cross *S. glareosa* emarginate variant x *S. maritima*.

Capsules : of *S. maritima* type, ovoid, 7·5 mm. long, 6·5 mm. broad, mouth 4 mm. diam., teeth strongly reflexed, 1·5 mm. long, 1·5 mm. broad at the base, carpophore 3 mm. long, 2·25 mm. diam.

Seeds : armadillo.

N. 146=*S. glareosa* emarginate variant K. 1099 plant 41 x *S. maritima* S.P.A. 13. 75 plants in the family.

Habit : spreading and all prostrate ; some, mostly few, overwintering shoots 37, none in 38 ; stems up to 4·3 dm.

Surface : all glabrous, all mat.

Leaves : all intermediate but nearer to S.P.A. 13.

Anthocyanin in vegetative parts : medium 47 : little 28.

Inflorescence : number of flowers 7/61, 8/3, 9/4, 10/2, 11/2, 12/1, 13/1, 15/1.

Calyx : inflated 4 : subinflated 71 ; anthocyanin medium 62 : little 13.

Petals : colour Marguerite Yellow 15 : white 60 ; entire 1 : bilobed 72: multilobed 2 ; entire 1 : emarginate 10 : 1/4-lobing 5 : 1/3-lobing 7 : 1/2-lobing 20 : 2/3-lobing 6 : 3/4-lobing 26 ; small scale 2 : boss 69 : none 4 ; blotch none ; petals not overlapping 75 ; segments not overlapping 74.

Sex : hermaphrodite 11 : hermaphrodite and female 3 : female 61.

Androecium : filaments purple 10 : white 4 ; anthers purple 13 ; with non-polliniferous anthers 33 ; petaloid staminodes 1.

Gynoecium : stigmata purple 69 : white 6 ; immature seeds purple 74.

Capsules : *S. maritima* type 70.

Mature seeds : armadillo 26 : weak armadillo 42.

Sterility : much occurred in this family in open pollination.

N. 146 plant 18 gave an average of 4·7 seeds per capsule from 18 capsules, a total of 83 seeds from which only 7 plants were raised.

N. 146 plant 15 gave an average of 5·3 seeds per capsule from 25 capsules. a total of 133 seeds from which only 19 plants were raised.

N. 146 plant 24 gave an average of 4·4 seeds per capsule from 18 capsules, a total of 80 seeds from which only 19 plants were raised.

All the above were from selfing under full control.

N. 146 plant 18 had anthocyanin in vegetative parts little ; 7 flowers ; calyx subinflated with medium anthocyanin ; petals white, bilobed, 1/4 to 1/3-lobing, boss ; hermaphrodite ; filaments purple ; stigmata purple ; mature seeds armadillo.

N. 146 plant 15 had anthocyanin in vegetative parts little ; 7 flowers ; calyx sub-inflated with medium anthocyanin ; petals white, bilobed, 3/4-lobing, boss ; hermaphrodite ; filaments purple ; stigmata purple ; mature seeds weak armadillo.

N. 146 plant 24 had anthocyanin in vegetative parts little ; 7 flowers ; calyx subinflated with little anthocyanin ; petals white, bilobed, 3/4

lobing, small scale ; hermaphrodite ; filaments purple ; stigmata purple ; mature seeds weak armadillo.

S.P.A. 13 was described in K.B. 1929, 150 and a family raised by selfing it in K.B. 1933, 357. It and its offspring on selfing were typical *S. maritima*. S.P.A. 13 had subinflated (ellipsoid) calyx, poor petals, petals and segments not overlapping, bilobed, 3/4-lobing, small scale, no blotch, filaments white, anthers purple, white stigmata, purple immature seeds, mature seeds armadillo.

N. 274=N. 146 plant 18 selfed. 7 plants in the family.

Habit : subprostrate and spreading 6 : suberect and subspreading 1 ; no overwintering barren shoots ; stems up to 3·6 dm.

Surface : all glabrous, all mat.

Leaves : HM 2 : MH 2 : GH 2 : HG 1.

Anthocyanin in vegetative parts : medium 4 : little 3.

Inflorescence : number of flowers 4/4, 7/1, 10/1, 18/1.

Calyx : inflated 4 ; subinflated 3 ; anthocyanin much 1 : medium 5 : little 1.

Corolla : white 7 ; petals bilobed 7 ; 1/2-lobing 3 : 2/3-lobing 2 : 2/3-3/4-lobing 1 ; boss 7 ; anthocyanin blotch none ; petals overlapping 1 : not overlapping 6 ; segments overlapping 1 : not overlapping 6.

Sex : hermaphrodite 3 : hermaphrodite and female 1 : female 3.

Androecium : filaments purple 2 : white 2 ; anthers purple 4 ; no non-polliferous anthers and no petaloid staminodes.

Gynoecium : stigmata purple 4 : white 3 ; immature seeds purple 6 : white 1.

Capsules : *S. maritima* type 3.

Mature seeds : armadillo 3.

Sterility : much occurred in the family, with open pollination.

N. 275=N. 146 plant 15 selfed. 19 plants in the family.

Habit : subprostrate and spreading 13 : suberect and subspreading 6 ; overwintering barren shoots present in good numbers ; stems up to 3·6 dm.

Surface : all glabrous, all mat.

Leaves : M 6 : HM 5 : H 6 : G H 2.

Anthocyanin in vegetative parts : medium 8 : little 11.

Inflorescence : number of flowers 3/1, 4/1, 7/7, 9/2, 10/1, 11/1, 13/2, 15/4.

Calyx : inflated 2 : subinflated 15 : narrow 2 ; anthocyanin medium 17 : little 2.

Corolla : Marguerite Yellow 5 : white 14 ; petals bilobed 19 ; emarginate 3 : 1/3-lobing 2 : 1/2-lobing 1 : 2/3-lobing 6 : 3/4-lobing 7 ; scale 1 : small scale 7 : boss 6 : none 5 ; anthocyanin blotch present 1 : absent 18 ; petals overlapping 8 : not overlapping 10 ; segments overlapping 4 : not overlapping 14 ; poor petal 1.

Sex : hermaphrodite 5 : female 14.

Androecium : filaments purple 3 : white 2 ; anthers purple 5 ; non-polliniferous anthers 8 ; petaloid staminodes 3. Plant 13 had petaloid staminodes which were cream, bilobed, and indistinguishable from the petals.

Gynoecium : stigmata purple 13 : white 6 ; immature seeds purple 15 : white 4.

Capsules : *S. maritima* type 15.

Mature seeds : armadillo 7 : weak armadillo 3.

Sterility : much occurred in the family, with open pollination.

N. 276=N. 146 plant 24 selfed. 19 plants in the family.

Habit : subprostrate and spreading ; some overwintering barren shoots, but mostly die back ; stems up to 4·0 dm.

Surface : all glabrous, all mat.

Leaves : HM 2 : MH 3 : GH 7 : HG 6 : G 1.

Anthocyanin in vegetative parts : medium 17 : little 2.

Inflorescence : number of flowers 6/1, 7/15, 8/2, 13/1.

Calyx : inflated 3 : subinflated 16 ; anthocyanin medium 16 : little 3.

Corolla : Marguerite Yellow 1 : white 18 ; bilobed 19 ; 1/3-lobing 3 : 1/2-lobing 5 : 2/3-lobing 6 : 3/4-lobing 5 ; scale 7 : small scale 5 : boss 7 ; anthocyanin blotch absent 19 ; petals overlapping 16 : not overlapping 3 ; segments not overlapping 19.

Sex : hermaphrodite 9 : hermaphrodite and female 1 : female 9.

Androecium : filaments purple 10; anthers purple 10 ; non-polliniferous anthers 4 ; petaloid staminodes 0.

Gynoecium : stigmata purple 17 : white 2 ; immature seeds purple 17 : white 2.

Capsules : *S. maritima* type 16.

Mature seeds : armadillo 3 : weak armadillo 3 : weak tubercled 2.

Sterility : much with open pollination.

N. 147=*S. glareosa* emarginate variant K. 1099 plant 41 x *S. maritima* S.P.A. 70. 77 plants in the family.

Habit : spreading and subprostrate ; no overwintering barren shoots but 33 showed a little green ; stems up to 4·5 dm.

Surface : all glabrous, all mat.

Leaves : all intermediate but nearer to S.P.A. 70.

Anthocyanin in vegetative parts : much 1 : medium 67 : little 9.

Inflorescence : number of flowers 7/69, 8/1, 9/1, 10/2, 11/1, 12/2, 13/1.

Calyx : inflated 2 : subinflated 74 : narrow 1 ; anthocyanin much 1 : medium 70 : little 6.

Corolla : Marguerite Yellow 23 : white 54 ; petals entire 10 : bilobed 66 ; emarginate 34 : 1/4-lobing 2 : 1/3 lobing 10 : 1/2 lobing 12 : 2/3-lobing 4 : 3/4-lobing 5 ; boss 41 : none 36 ; anthocyanin blotch present 1 : absent 76 ; petals not overlapping 77 ; segments not overlapping 77.

Sex : hermaphrodite 16 : hermaphrodite and female 1 : female 60.

Androecium : filaments purple 12 : white 5 ; anthers purple 17 ; non-polliniferous anthers 16 ; petaloid staminodes 6.

Gynoecium : stigmata purple 71 : white 6 ; immature seeds purple 77.

Capsules : *S. maritima* type 77.

Mature seeds : armadillo 30 : weak armadillo 47.

Sterility : seed setting was better than in N. 146 but reproductive capacity was low from controlled selfings.

N. 147 plant	Total seeds	Capsules in which seeds counted	Average per capsule
8	128	17	7·5
2	169	25	6·8
7	164	22	7·5
6 x 7	220	10	22·0
N. 147/6 x N. 104/10	141	5	28·2
N. 147/6 x N. 104/11	69	3	23·0

N. 147 plant 8 had medium anthocyanin in vegetative parts ; 10 flowers ; calyx subinflated with medium anthocyanin ; petals white, bilobed, 2/3 to 3/4-lobing, boss, blotch absent ; hermaphrodite ; filaments white ; no non-polliniferous anthers and no petaloid staminodes ; stigmata purple ; mature seeds weak armadillo.

N. 147 plant 2 had medium anthocyanin in vegetative parts ; 7 flowers ; calyx inflated with medium anthocyanin ; petals white, bilobed, 2/3 to 3/4-lobing, boss, blotch absent ; hermaphrodite ; filaments purple ; no non-polliniferous anthers and no petaloid staminodes ; stigmata purple ; mature seeds weak armadillo.

N. 147 plant 7 had medium anthocyanin in vegetative parts ; 7 flowers ; calyx inflated with medium anthocyanin ; petals white, bilobed, 2/3 to 3/4-lobing, boss, blotch absent ; hermaphrodite ; filaments white ; no non-polliniferous anthers or petaloid staminodes ; stigmata purple ; mature seeds weak armadillo.

N. 147 plant 6 had medium anthocyanin in vegetative parts ; 7 flowers ; subinflated calyx with medium anthocyanin ; petals white, entire, no boss, blotch absent ; female ; stamens intermediate between vestigial and petaloid ; stigmata purple ; mature seeds armadillo.

N. 104, a selfing of S.P. 70, was described in K.B. 1939, 298. The parent and the family of 126 plants were all typical *S. maritima* and S.P. 70 bred true for all characters of specific value and for most intraspecific variables as well—especially for long cylindric calyces.

N. 104 plant 10 had petals and segments both overlapping ; N. 104 plant 11 had petals overlapping and segments not overlapping ; both had petals multilobed, anthocyanin blotch absent, filaments white, hermaphrodite flowers, purple stigmata, armadillo seeds. These characters are those of S.P. 70 except that the latter had a trace of anthocyanin in the filaments.

N. 268=N. 147 plant 8 selfed. 15 plants in the family.

Habit : suberect 13, prostrate and spreading to subspreading 2 ; some overwintering barren shoots, but mostly die back ; stems up to 5·0 dm.

Surface : all glabrous, all mat.

Leaves : M 2 : HM 4 : MH 9.

Anthocyanin in vegetative parts : much 1 : medium 14.

Inflorescence : number of flowers 3/2, 6/1, 7/7, 9/1, 11/2, 12/1, 15/1.

Calyx : subinflated 6 : long subinflated 3 : long cylindric 6 ; anthocyanin medium 11 : little 4.

Corolla : Marguerite Yellow 1 : white 14 ; petals bilobed 13 : multilobed 2 ; entire to emarginate 1 : emarginate 2 : 1/4-lobing 1 ; 1/3 to 2/3-lobing 1 : 1/2-lobing 2 : 1/2 to 2/3-lobing 1 : 2/3-lobing 2 : 3/4-lobing 5 ; boss 13 : none 2 ; anthocyanin blotch absent 15 ; petals overlapping 7 : not overlapping 8 ; segments not overlapping 15.

Sex : hermaphrodite 2 : hermaphrodite and female 4 : female 9.

Androecium : filaments purple 1 : white 5 ; anthers purple 6 ; with non-polliniferous anthers 1 ; petaloid staminodes 0.

Gynoecium : stigmata purple 15 ; immature seeds purple 14 : white 1.

Capsules : *S. maritima* type 10.

Mature seeds : armadillo 1 : weak armadillo 6 : weak tubercled 3.

Sterility : occurred with open pollination.

N. 269=N. 147 plant 3 selfed. 36 plants in the family.

Habit : suberect and spreading 9, subprostrate and spreading 27 ; stems up to 3·9 dm.

Surface : all glabrous, all mat.

Leaves : M 5 : HM 22 : MH 5 : GH 3 : HG 1.

Anthocyanin in vegetative parts : much 2 : medium 34.

Inflorescence : number of flowers 3/5, 4/1, 5/1, 6/3, 7/20, 8/3, 9/2, 10/1.

Calyx : large inflated 18 : subinflated 14 : long subinflated 3 : long cylindric 1 ; anthocyanin much 6 : medium 26 : little 4.

Corolla : Marguerite Yellow 16 : white 20 ; petals bilobed 35 : multilobed 1 ; entire to emarginate 3 : entire to 1/3-lobing 1 ; emarginate 1 : 1/3-lobing 7 : 1/3 to 1/2-lobing 2 : 1/2-lobing 3 : 1/2 to 2/3-lobing 1 : 2/3-lobing 9 : 3/4-lobing 9 ; boss 31 : none 5 ; anthocyanin blotch

present 3 : absent 33 ; petals overlapping 21 : not overlapping 15 ; segments not overlapping 36.

Sex : hermaphrodite 3 : hermaphrodite and female 3 : female 30.

Androecium : filaments purple 5 : white 1 ; anthers purple 6 ; with non-polliniferous anthers 12 ; petaloid staminodes 2.

Gynoecium : stigmata purple 35 : white 1 ; immature seeds purple 32 : white 3.

Capsules : *S. maritima* type 27 : hybrid type 3.

Mature seeds : armadillo 9 : weak armadillo 20 : tubercled 1.

Sterility : occurred irregularly with open pollination.

N. 278=N. 147 plant 7 selfed. 4 plants in the family.

Habit : subprostrate and spreading 4 ; no overwintering barren shoots ; stems up to 3·5 dm.

Surface : all glabrous, all mat.

Leaves : M 1 : MH 2 : H 1.

Anthocyanin in vegetative parts : medium 4.

Calyx : large inflated 1 : subinflated 2 : long subinflated 1 ; anthocyanin medium 4.

Corolla : Marguerite Yellow 1 : white 3 ; petals bilobed 4 ; 2/3-lobing 2 ; 2/3 to 3/4-lobing 1 ; 3/4-lobing 1 ; boss 4 ; anthocyanin blotch absent 4 ; petals overlapping 1 : not overlapping 3 ; segments not overlapping 4.

Sex : hermaphrodite 1 : female 3.

Androecium : filaments purple 1 ; anthers purple 1 ; non-polliniferous anthers 0 ; petaloid stamens 0.

Gynoecium : stigmata purple 4 ; immature seeds purple 4.

Capsules : *S. maritima* type 1.

Mature seeds : armadillo 1.

Sterility : much with open pollination.

N. 300=N. 147 plant 6 x N. 147 plant 7. 29 plants in the family.

Habit : suberect 4 : subprostrate and spreading ·25 ; no overwintering barren shoots ; stems up to 4·3 dm.

Surface : all glabrous, all mat.

Leaves : M 2 : HM 13 : MH 12 : GH 1 : HG 1.

Anthocyanin in vegetative parts : much 1 : medium 28.

Inflorescence : number of flowers 3/5, 5/2, 6/1, 7/20, 11/1.

Calyx : large inflated 7 : inflated 3 : subinflated 11 : long subinflated 4 : long cylindric 4 ; anthocyanin much 4 : medium 25.

Corolla : Marguerite Yellow 12 : white 17 ; petals entire 1 : bilobed 26 ; multilobed 2 ; entire 1, entire to emarginate 1, entire to 1/4-lobing 2, entire to 1/3-lobing 2, emarginate 3, emarginate to 1/4-lobing 1, emarginate to 1/3-lobing 1, 1/4-lobing 2, 1/4 to 1/2-lobing 1,

1/3-lobing 1, 1/3 to 1/2-lobing 2, 1/3 to 2/3-lobing 3, 1/2-lobing 3, 1/2–2/3-lobing 3, 2/3-lobing 2, 2/3 to 3/4-lobing 1 ; boss 20 : none 9 ; anthocyanin blotch absent 29 ; petals overlapping 17 : not overlapping 11 ; segments not overlapping 27.

Sex : hermaphrodite 4 : hermaphrodite and female 9 : female 16.

Androecium : filaments purple 8 : white 5 ; anthers purple 13 ; non-polliniferous anthers 5 ; petaloid staminodes 5.

Gynoecium : stigmata purple 26 : white 3 ; immature seeds purple 24 : white 4.

Capsules : *S. maritima* type 28.

Mature seeds : armadillo 21 : weak armadillo 6.

Sterility : not marked with open pollination.

N. 271=N. 147 plant 6 x N. 104 plant 10. 67 plants in the family.

Habit : suberect and spreading 8 : subprostrate and spreading 59 ; some overwintering barren shoots, but mostly die back ; stems up to 3·7 dm.

Surface : all glabrous, all mat.

Leaves : M 21 : HM 37 : MH 8.

Anthocyanin in vegetative parts : much 6 : medium 61.

Inflorescence : number of flowers 2/1, 3/24, 4/6, 5/7, 7/29.

Calyx : inflated 24 : subinflated 6 : long subinflated 9 : long cylindric 28 ; anthocyanin much 6 : medium 61.

Corolla : Marguerite Yellow 36 : white 31 ; petals entire 3 : bilobed 59 : multilobed 5 ; entire 3 : entire to emarginate 4 : entire to 1/4-lobing 3 : emarginate 8 : emarginate to 1/4-lobing 2 : emarginate to 1/3-lobing 2 : emarginate to 3/4-lobing 1 : 1/4-lobing 6 : 1/4 to 1/3-lobing 3 : 1/4 to 1/2-lobing 3 : 1/4 to 2/3-lobing 2 : 1/4 to 3/4-lobing 3 : 1/3-lobing 1 : 1/3 to 1/2-lobing 4 : 1/3 to 2/3-lobing 2 : 1/3 to 3/4-lobing 3 : 1/2-lobing 3 : 1/2 to 2/3-lobing 6 : 1/2 to 3/4-lobing 2 : 2/3-lobing 3 : 2/3 to 3/4-lobing 2 ; small scale 5 : boss 49 : none 13 ; anthocyanin blotch present 1 : absent 66 ; petals overlapping 55 : not overlapping 12 ; segments overlapping 2 : not overlapping 62.

Sex : hermaphrodite 10 : hermaphrodite and female 24 : female 33.

Androecium : filaments purple 18 : white 15 ; anthers purple 33 ; non-polliniferous anthers 4 ; petaloid staminodes 11.

Gynoecium : stigmata purple 57 ; immature seeds purple 57.

Capsules : *S. maritima* type 65.

Mature seeds : armadillo 65.

Sterility : not marked with open pollination.

N. 307=N. 147 plant 6 x N. 104 plant 11. 16 plants in the family.

Habit : suberect and spreading 6 : subprostrate and spreading 10 ; some overwintering barren shoots, but mostly die back ; stems up to 4·2 dm.

Surface : all glabrous, all mat.

Leaves : HM 5 : MH 10 : GH 1.

Anthocyanin in vegetative parts : medium 15 : little 1.

Inflorescence : number of flowers 4/4, 5/2, 6/3, 7/7.

Calyx : large inflated 12 : subinflated 3 : long cylindric 1 ; anthocyanin medium 16.

Corolla : Marguerite Yellow 9 : white 7 ; petals entire 4 : bilobed 11 : multilobed 1 ; entire 4 : entire to emarginate 4 : emarginate 3 : 1/3-lobing 3 : 2/3-lobing 2 ; boss 12 : none 4 ; anthocyanin blotch present 4 : absent 12 ; petals overlapping 14 : not overlapping 2 ; segments not overlapping 12.

Sex : hermaphrodite 1 : hermaphrodite and female 1 : female 14.

Androecium : filaments purple 2 ; anthers purple 2 ; non-polliniferous anthers 3 ; petaloid staminodes 3.

Gynoecium : stigmata purple 16 ; immature seeds purple 16.

Capsules : *S. maritima* type 16.

Mature seeds : armadillo 16.

Sterility : not marked with open pollination.

N. 148=*S. glareosa* emarginate variant K. 1099 plant 41 x *S. maritima* S.P.A. 15. 77 plants in the family.

Habit : all spreading and prostrate ; no overwintering barren shoots except a little green in 21 plants ; stems up to 4·0 dm.

Surface : all glabrous and mat.

Leaves : all about intermediate but with some range in breadth and nearer to S.P.A. 15.

Anthocyanin in vegetative parts : much 52 : medium 25.

Inflorescence : number of flowers 3/5, 4/6, 5/3, 6/2, 7/58, 8/1, 10/1, 12/1, 13/1.

Calyx : subinflated 61 : narrow-clyndric 16 ; anthocyanin medium 71 : little 6.

Corolla : Marguerite Yellow 11 : white 66 ; bilobed 74 : multilobed 3 ; petals emarginate 21 : 1/4-lobing 8 : 1/3-lobing 6 : 1/2-lobing 16 : 2/3-lobing 11 : 3/4-lobing 15 ; small scale 1 : boss 60 : none 11 ; anthocyanin blotch present 31 : absent 46 ; petals overlapping 1 : not overlapping 76 ; segments not overlapping 77.

Sex : hermaphrodite 43 : female 34.

Androecium : filaments purple 34 : white 9 ; anthers purple 43 ; with non-polliniferous anthers 15 ; petaloid staminodes 2.

Gynoecium : stigmata purple 65 : white 12 ; immature seeds purple 77.

Capsules : *S. maritima* type 76.

Mature seeds : armadillo 25 : weak armadillo 51.

Sterility : little occurred with open pollination. With controlled pollinations the following results were obtained.

N. 148 plant	Total seeds	Capsules in which seeds counted	Average per capsule	Plants raised
37	372	37	10·1	61
47	254	29	8·8	27
59	405	14	28·9	32
57	303	24	12·2	43
52	334	17	19·7	11

N. 148 plant 37 had anthocyanin in vegetative parts medium ; 7 flowers ; calyx subinflated with medium anthocyanin ; petals white, bilobed, 1/3 to 2/3-lobing, boss, no blotch ; hermaphrodite ; filaments white ; stigmata white ; mature seeds weak armadillo.

N. 148 plant 47 had anthocyanin in vegetative parts much ; 7 flowers ; calyx subinflated with medium anthocyanin ; petals white, bilobed, 2/3 to 3/4-lobing, boss, blotch present ; hermaphrodite ; filaments purple ; stigmata purple ; mature seeds weak armadillo.

N. 148 plant 59 had anthocyanin in vegetative parts medium ; 7 flowers ; calyx subinflated with little anthocyanin ; petals white, bilobed, 1/2 to 2/3-lobing, boss, blotch present ; hermaphrodite ; filaments purple ; stigmata purple ; mature seeds weak armadillo.

N. 148 plant 57 had anthocyanin in vegetative parts much ; 7 flowers ; calyx narrow-cylindric with medium anthocyanin ; petals white, bilobed, 1/2-lobing, boss, blotch present ; hermaphrodite ; filaments purple ; stigmata purple ; mature seeds weak armadillo.

N. 148 plant 52 had anthocyanin in vegetative parts much ; 7 flowers ; calyx subinflated with medium anthocyanin ; petals white, bilobed, emarginate to 1/2-lobing, boss, blotch absent ; hermaphrodite ; filaments purple ; stigmata purple ; mature seeds armadillo.

S.P.A. 15, a narrow-leaved *S. maritima*, was described in K.B. 1929, 151. It had very much anthocyanin in vegetative parts and calyx ; calyx narrow-cylindric ; petals overlapping and segments not overlapping, scale, blotch present, hermaphrodite, stigmata white, immature seeds purple, mature seeds armadillo.

N. 272=N. 148 plant 37 selfed. 61 plants in the family.

Habit : suberect and subspreading 25 : subprostrate and subspreading 34 ; some overwintering barren shoots, but mostly die back ; stems up to 3·0 dm.

Surface : all glabrous and mat.

Leaves : M 3 : HM 13 : MH 24 : H 7 : GH 2 : HG 2 : G 1 and, in addition, 4 with shorter and broader leaves.

Anthocyanin in vegetative parts : much 19 : medium 40 : little 2.

Inflorescence : number of flowers 2/1, 3/26, 4/5, 5/4, 6/5, 7/18.

Calyx : subinflated 40 : narrow-cylindric 21 ; anthocyanin much 2 : medium 58 : little 1.

Corolla : Marguerite Yellow 21 : white 39 ; petals entire 7 : bilobed 51 : multilobed 1 ; entire 7 : entire to emarginate 3 : emarginate 9 : emarginate to 1/3-lobing 6 : 1/3-lobing 11 : 1/3 to 1/2-lobing 3 : 1/2-lobing 9 : 2/3-lobing 9 : 2/3 to 3/4-lobing 1 : 3/4-lobing 2 ; small scale 1 : boss 44 : none 15 ; anthocyanin blotch present 10 : absent 50 ; petals overlapping 28 : not overlapping 32 ; segments not over-lapping 41.

Sex : hermaphrodite 12 : hermaphrodite and female 3 : female 46.

Androecium : filaments white 15 ; anthers purple 15 ; non-polliniferous anthers 2 ; petaloid staminodes 6.

Gynoecium : stigmata purple 44 : white 17 ; immature seeds purple 35 : white 16.

Capsules : *S. maritima* type 40.

Mature seeds : armadillo 18 : weak armadillo 22.

Sterility : considerable with open pollination.

N. 273=N. 148 plant 47 selfed. 27 plants in the family.

Habit : suberect and subspreading 1 : prostrate, ascending at ends, and sub-spreading 26 ; some overwintering barren shoots, but mostly die back ; stems up to 3·7 dm.

Surface : all glabrous and mat.

Leaves : M 1 : HM 11 : MH 11 : H 4.

Anthocyanin in vegetative parts : much 22 : medium 5.

Inflorescence : number of flowers 2/3, 3/4, 4/5, 5/4, 6/2, 7/8.

Calyx : inflated 1 : subinflated 7 : narrow-cylindric 16 ; anthocyanin much 1 : medium 23.

Corolla : Marguerite Yellow 5 : white 19 ; petals bilobed 25 ; emarginate 1 : emarginate to 1/3-lobing 1 : 1/3-lobing 2 : 1/3 to 1/2-lobing 3 : 1/2-lobing 2 : 1/2 to 2/3-lobing 1 : 2/3-lobing 5 : 3/4-lobing 10 ; scale 1 : small scale 5 : boss 14 : none 5 ; anthocyanin blotch present 18 : absent 7 ; petals overlapping 22 : not overlapping 3 ; segments not overlapping 24.

Sex : hermaphrodite 7 : hermaphrodite and female 2 : female 16.

Androecium : filaments purple 2 : white 7 ; anthers purple 9 ; non-polliniferous anthers 9 ; petaloid staminodes 4.

Gynoecium : stigmata purple 15 : white 10 ; immature seeds purple 11 : white 9.

Capsules : *S. maritima* type 10.

Mature seeds : armadillo 6 : weak armadillo 4.

Sterility : very considerable with open pollination.

N. 282=N. 148 plant 59 selfed. 32 plants in the family.

Habit : suberect and subspreading 2 : prostrate, ascending at ends, and subspreading 30 ; overwintering shoots present in good numbers ; stems up to 3·4 dm.

Surface : all glabrous and mat.

Leaves : HM 18 : MH 8 : H 3 : GH 2 : HG 1.

Anthocyanin in vegetative parts : much 31 : medium 1.

Inflorescence : number of flowers 3/6, 4/2, 6/3, 7/17, 9/1, 10/1, 11/1.

Calyx : subinflated 15 : narrow-cylindric 16 ; anthocyanin medium 20 : little 11.

Corolla : Marguerite Yellow 12 : white 19 ; petals bilobed 31 ; emarginate 5 : emarginate to 1/3-lobing 1 : 1/3-lobing 4 : 1/3 to 2/3-lobing 1 : 1/2-lobing 2 : 1/2 to 2/3-lobing 1 : 2/3-lobing 10 : 2/3 to 3/4-lobing 1 : 3/4-lobing 6 ; small scale 1 : boss 28 : none 2 ; anthocyanin blotch present 16 : absent 15 ; petals overlapping 31 ; segments not overlapping 26.

Sex : hermaphrodite 18 : hermaphrodite and female 2 : female 8.

Androecium : filaments purple 11 : white 9 ; anthers purple 20 ; non-polliniferous anthers 4 ; petaloid staminodes 1.

Gynoecium : stigmata purple 23 : white 8 ; immature seeds purple 14 : white 8.

Capsules : *S. maritima* type 27.

Mature seeds : armadillo 10 : weak armadillo 14.

Sterility : some with open pollination.

N. 283=N. 148 plant 57 selfed. 43 plants in the family.

Habit : suberect and subspreading 43 ; some overwintering barren shoots, but mostly die back ; stems up to 3·7 dm.

Surface : all glabrous and mat.

Leaves : M 11 : HM 28 : MH 4.

Anthocyanin in vegetative parts : much 39 : medium 4.

Inflorescence : number of flowers 3/15, 4/1, 5/3, 6/4, 7/17, 8/1, 9/1, 10/1.

Calyx : subinflated 1 : narrow-cylindric 42 ; anthocyanin much 14 : medium 28 : little 1.

Corolla : Marguerite Yellow 8 : white 35 ; petals entire 3 : bilobed 37 : multilobed 1 ; entire 3 : entire to emarginate 2 : emarginate 19 : emarginate to 1/4-lobing 1 : 1/4 to 1/2-lobing 1 : 1/3-lobing 4 : 1/2-lobing 8 : 1/2 to 2/3-lobing 1 : 2/3-lobing 1 : 2/3 to 3/4-lobing 1 : 3/4-lobing 2 ; small scale 2 : boss 25 : none 16 ; anthocyanin blotch present 12 : absent 31 ; petals overlapping 41 : not overlapping 2 ; segments not overlapping 40.

Sex : hermaphrodite 13 : female 30.

Androecium : filaments purple 10 : white 3 ; anthers purple 13 ; non-polliniferous anthers 6 ; petaloid staminodes 5.

Gynoecium : stigmata purple 40 : white 3 ; immature seeds purple 32 : white 7.

Capsules : *S. maritima* type 34.

Mature seeds : armadillo 16 : weak armadillo 16.

Sterility : considerable with open pollination.

N. 320=N. 148 plant 52 selfed. 11 plants in the family.

Habit : suberect and subspreading 11 ; no overwintering barren shoots ; stems up to 2·5 dm.

Surface : all glabrous and mat.

Leaves : M 6 : HM 4 : MH 1.

Anthocyanin in vegetative parts : much 3 : medium 6 : little 2.

Inflorescence : number of flowers 3/2, 5/2, 7/6.

Calyx : subinflated 10 : narrow-cylindric 1 ; anthocyanin medium 11.

Corolla : Marguerite Yellow 6 : white 5 ; petals entire 2 : bilobed 9 ; entire 2 : entire to emarginate 1 : entire to 1/3-lobing 1 : emarginate 4 : 1/2-lobing 2 : 1/3-lobing 1 ; small scale 1 : boss 2 : none 8 ; anthocyanin blotch present 1 : absent 10 ; petals not overlapping 11 ; segments not overlapping 9.

Sex : hermaphrodite 2 : female 9.

Androecium : filaments purple 1 : white 1 ; anthers purple 2 ; non-polliniferous anthers 0 ; petaloid staminodes 8.

Gynoecium : stigmata purple 6 : white 5 ; immature seeds purple 5 : white 4.

Capsules : *S. maritima* type 8.

Mature seeds : armadillo 8.

Sterility : much in open pollination.

N. 149=*S. glareosa* emarginate variant K. 1099 plant 41 x *S. maritima* N. 18 plant 11. 89 plants in the family.

Habit : all prostrate and spreading ; no overwintering barren shoots, except a little green showing in 25 plants ; stems up to 4·5 dm.

Surface : all glabrous and mat.

Leaves : intermediate but nearer to N. 18 plant 11.

Anthocyanin in vegetative parts : little 89.

Inflorescence : number of flowers 5/2, 7/77, 8/3, 9/3, 10/2, 14/2.

Calyx : inflated 1 : subinflated 6 : narrow-cylindric 2 ; anthocyanin medium 3 : little 86.

Corolla : Marguerite Yellow 22 : white 67 ; petals bilobed 88 ; emarginate 9 : 1/4-lobing 23 : 1/3-lobing 3 : 1/2-lobing 14 : 2/3-lobing 22 : 3/4-lobing 18 ; scale 2 : small scale 20 : boss 50 : none 17 ; blotch absent 89 ; petals not overlapping 89 ; segments not overlapping 89.

Sex : hermaphrodite 31 : hermaphrodite and female 11 : female 47.

Androecium : filaments purple 22 : white 19 ; anthers purple 1 : yellow-green 40 ; non-polliniferous anthers 3 ; petaloid staminodes 4.

Gynoecium : stigmata purple 73 : white 16 ; immature seeds purple 88.

Capsules : *S. maritima* type 85.

Mature seeds : armadillo 41 : weak armadillo 44.

Sterility : not marked with open pollination.

From controlled selfings the results were :

N. 149 plant	Total seeds	Capsules in which seeds counted	Average per capsule	Plants raised
10	60	14	4·3	14
4	66	18	3·7	13
34 x N.18/11	109	18	6·1	49
4 x N.18/11	31	10	3·1	10
7 x N.18/11	33	8	4·1	10
10 x N.156/2	113	13	8·7	21
34 x N.156/2	63	10	6·3	28
7 x N.148/52	88	19	4·6	18

N. 149 plant 10 had 9 flowers ; calyx inflated with little anthocyanin ; petals white, 1/2 to 3/4-lobing, small scale ; hermaphrodite ; filaments white ; anthers yellow-green ; stigmata white ; seeds weak armadillo.

N. 149 plant 4 had 7 flowers ; calyx subinflated with little anthocyanin ; petals white, emarginate to 1/2-lobing, boss ; hermaphrodite ; filaments white ; anthers yellow-green ; stigmata white ; seeds armadillo.

N. 149 plant 34 had 7 flowers ; calyx subinflated with little anthocyanin ; petals Marguerite Yellow, emarginate to 1/4-lobing, no corona ; female ; petaloid staminodes ; stigmata purple ; seeds armadillo.

N. 149 plant 7 had 7 flowers ; calyx subinflated with little anthocyanin ; petals Marguerite Yellow, emarginate, no corona ; female ; petaloid staminodes ; stigmata purple ; seeds armadillo.

N. 18=S.P.A. 20 selfed (see K.B. 1929, 153 ; K.B. 1932, 231).

N. 18 plant 11 had no anthocyanin except in immature seeds ; calyx narrow-ellipsoid ; petals white, 3/4-lobing, small scale, no blotch, petals and segments not overlapping ; mature seeds armadillo.

N. 156=N. 18 plant 11 selfed.

N. 156 plant 2 had vegetative characters as parent, no anthocyanin in any part of plant except in immature seeds, calyx narrow ellipsoid, bilobed petals with 3/4-lobing, scale, no blotch, petals and segments not overlapping, hermaphrodite, seeds armadillo.

N. 270=N. 149 plant 10 selfed. 13 plants in the family.

Habit : compact base, 3 with erect, 7 with suberect, and 3 with prostrate stems ; overwintering barren shoots present in considerable numbers ; stems up to 2·9 dm.

Surface : all glabrous and mat.

Leaves : M 5 : HM 1 : MH 5 : H 2.

Anthocyanin in vegetative parts : medium 4 : little 4 : none 5.

Inflorescence : number of flowers 7/9, 8/2, 12/1, 15/1.

Calyx : large inflated 2 : inflated 1 : subinflated 10 ; anthocyanin medium 8 : none 5.

Corolla : Marguerite Yellow 2 : white 11 ; petals bilobed 13 ; 1/3-lobing 3 : 1/2-lobing 5 : 2/3-lobing 3 : 3/4-lobing 2 : scale 1 : small scale 2 : boss 8 : none 2 ; blotch absent 13 ; petals overlapping 10 ; not overlapping 3 ; segments not overlapping 12.

Sex : hermaphrodite and female 1 : female 12.

Androecium : filaments white 1 ; anthers purple 1 ; non-polliniferous anthers 3 ; petaloid staminodes 1.

Gynoecium : stigmata purple 6 : white 7 ; immature seeds purple 8 : white 2.

Capsules : *S. maritima* type 1.

Mature seeds : weak armadillo 1.

Sterility : complete with open pollination.

N. 321=N. 149 plant 4 selfed. 13 plants in the family.

Habit : compact base 11, loose base 2, suberect stems 9, prostrate 4 ; overwintering barren shoots present in considerable numbers ; stems up to 3·9 dm.

Surface : all glabrous and mat.

Leaves : M 2 : HM 6 : MH 4 : H 1.

Anthocyanin in vegetative parts : medium 5 : little 3 : none 5.

Inflorescence : number of flowers 3/3, 7/10.

Calyx : large inflated 1 : subinflated 11 : narrow-cylindric 1 ; anthocyanin medium 6 : little 3 : none 4.

Corolla : white 13 ; bilobed 10 : multilobed 1 ; petals entire to emarginate 2 : emarginate 2 : emarginate to 2/3-lobing 1 : 1/4 to 1/3-lobing 1 : 1/4 to 1/2-lobing 1 : 1/3 to 2/3-lobing 1 : 1/2 to 2/3-lobing 2 : 2/3 to 3/4-lobing 1 : 3/4-lobing 2 ; small scale 3 : boss 6 : none 4 ; blotch present 1 : absent 11 ; petals not overlapping 13 ; segments overlapping 2 : not overlapping 7.

Sex : female 13.

Androecium : non-polliniferous anthers 7 ; petaloid staminodes 2.

Gynoecium : stigmata purple 7 : white 6 ; immature seeds purple 10 : white 2.

Capsules : *S. maritima* type 11.

Mature seeds : armadillo 10.

Sterility : very considerable with open pollination.

N. 281=N. 149 plant 34 x N. 18 plant 11. 48 plants in the family.

Habit : compact base 45, loose base 3, erect stems 1, suberect 27, subprostrate 20 ; barren overwintering shoots present in considerable numbers ; stems up to 5·0 dm.

Surface : all glabrous and mat.

Leaves : M 10 : HM 13 : MH 19 : H 3 : GH 3.

Anthocyanin in vegetative parts : little 18 ; none 30.

Inflorescence : number of flowers 3/15, 4/2, 5/2, 6/2, 7/27.

Calyx : inflated 1 : subinflated 40 : narrow-cylindric 2 ; anthocyanin medium 8 : little 11 : none 29.

Corolla : white 48 ; petals bilobed 46 : multilobed 2 ; entire to 1/3-lobing 1 : emarginate 2 : emarginate to 1/2-lobing 1 : emarginate to 2/3-lobing 1 : 1/4 to 1/3-lobing 1 : 1/4 to 1/2-lobing 2 : 1/4 to 2/3-lobing 2 : 1/3 to 1/2-lobing 2 : 1/3 to 2/3-lobing 2 : 1/3 to 3/4-lobing 2 : 1/2 to 2/3-lobing 8 : 2/3-lobing 2 : 2/3 to 3/4-lobing 15 : 3/4-lobing 7 ; small scale 12 : boss 34 : none 2 ; blotch absent 48 ; petals overlapping 19 : not overlapping 29 ; segments overlapping 7 : not overlapping 41.

Sex : hermaphrodite 1 : female 47.

Androecium : filaments white 1 ; anthers purple 1 ; non-polliniferous anthers 17 : petaloid staminodes 10.

Gynoecium : stigmata purple 19 : white 29 ; immature seeds purple 44 : white 1.

Capsules : *S. maritima* type 41.

Mature seeds : armadillo 40.

Sterility : not marked in open pollination.

N. 291=N. 149 plant 4 x N. 18 plant 11. 10 plants in the family.

Habit : compact base 7, loose base 3, suberect stems 7, subprostrate 3 ; barren overwintering shoots present in considerable numbers ; stems up to 4·5 dm.

Surface : all glabrous and mat.

Leaves : M 5 : HM 1 : MH 2 : H 1 : HG 1.

Anthocyanin in vegetative parts : medium 3 : little 1 : none 6.

Inflorescence : number of flowers 3/5, 5/1, 6/2, 7/1, 9/1.

Calyx : inflated 6 : subinflated 4 ; anthocyanin medium 3 : little 1 : none 6.

Corolla : white 10 ; petals bilobed 7 : multilobed 3 ; emarginate 1 : 1/4 to 2/3-lobing 1 : 1/3 to 1/2-lobing 1 : 1/2 to 2/3-lobing 3 : 1/2 to 3/4-lobing 1 : 2/3 to 3/4-lobing 2 : 3/4-lobing 1 ; small scale 2 : boss 5 : none 3 ; blotch absent 9 : present 1 ; petals overlapping 7 : not overlapping 3 ; segments not overlapping 9.

Sex : female 10.

Androecium : non-polliniferous anthers 3 ; petaloid staminodes 1.

Gynoecium : stigmata purple 4 : white 6 ; immature seeds purple 8 : white 1.

Capsules : *S. maritima* type 9.

Mature seeds : armadillo 9.

Sterility : not marked in open pollination.

N. 305=N. 149 plant 7 x N. 18 plant 11. 10 plants in the family.
Habit : compact base 5, loose 5, suberect stems 6, subprostrate stems 4 ; overwintering barren shoots present in considerable numbers ; stems up to 4·2 dm.

Surface : all glabrous and mat.

Leaves : M 4 : HM 3 : MH 2 : H 1.

Anthocyanin in vegetative parts : little 7 : none 3.

Inflorescence : number of flowers 4/1, 7/7, 8/1, 15/1.

Calyx : large inflated 1 : inflated 3 : subinflated 6 ; anthocyanin medium 7 : none 3.

Corolla : white 10 ; petals bilobed 10 ; emarginate to 1/4-lobing 1 : 1/4-lobing 1 : 1/4 to 1/2-lobing 1 : 1/3 to 1/2-lobing 1 : 1/3 to 3/4-lobing 1 : 1/2-lobing 1 : 1/2 to 3/4-lobing 1 : 2/3 to 3/4-lobing 3 ; scale 2 : small scale 1 : boss 6 : none 1 ; blotch absent 10 ; petals overlapping 2 : not overlapping 8 ; segments not overlapping 10.

Sex : hermaphrodite and female 1 : female 9.

Androecium : filaments purple 1 ; anthers yellow-green 1 ; non-polliniferous anthers 3 ; petaloid staminodes 2.

Gynoecium : stigmata purple 7 : white 3 ; immature seeds purple 10.

Capsules : *S. maritima* type 10.

Mature seeds : armadillo 10.

Sterility : not marked in open pollination.

N. 303=N. 149 plant 10 x N.156 plant 2. 21 plants in the family.

Habit : compact base 4, loose 17, suberect 15, subprostrate 5, prostrate 1 ; overwintering barren shoots present in considerable numbers ; stems up to 3·5 dm.

Surface : all glabrous and mat.

Leaves : M 7 : HM 6 : MH 7 : H 1.

Anthocyanin in vegetative parts : little 14 : none 7.

Inflorescence : number of flowers 3/2, 4/3, 5/3, 6/2, 7/9, 8/1, 12/1.

Calyx : large inflated 5 : inflated 10 : subinflated 6 ; anthocyanin little 14 : none 7.

Corolla : white 21 ; petals bilobed 21 ; emarginate to 1/3-lobing 1 : 1/4 to 3/4-lobing 1 : 1/2 to 2/3-lobing 2 ; 2/3 to 3/4-lobing 8 : 3/4-lobing 9 ; scale 2 : small scale 16 : boss 3 ; blotch present 1 : absent 20 ; petals overlapping 16 : not overlapping 5 ; segments overlapping 10 : not overlapping 11.

Sex : hermaphrodite 1 : female 20.

Androecium : filaments white 1 ; anthers purple 1 ; non-polliniferous anthers 15 ; petaloid staminodes 5.

Gynoecium : stigmata purple 13 : white 8 ; immature seeds purple 21.

Capsules : *S. maritima* type 21.

Mature seeds : armadillo 6 : weak armadillo 15.

Sterility : not marked in open pollination.

N. 312=N. 149 plant 34 x N. 156 plant 2. 28 plants in the family.

Habit : compact base 10, loose 18, suberect 15, subprostrate 12, prostrate 1 ; overwintering barren shoots present in considerable numbers ; stems up to 5·9 dm.

Surface : all glabrous and mat.

Leaves : M 4 : HM 10 : MH 6 : H 8.

Anthocyanin in vegetative parts : little 13 : none 15.

Inflorescence : number of flowers 2/2, 3/1, 4/1, 5/1, 6/1, 7/21, 8/8.

Calyx : inflated 11 : subinflated 17 ; anthocyanin medium 13 : none 15.

Corolla : white 28 ; petals bilobed 26 : multilobed 2 ; emarginate 1 : emarginate to 1/4-lobing 1 : 1/4 to 1/3-lobing 1 : 1/3-lobing 1 : 1/3 to 1/2-lobing 4 : 1/3 to 2/3-lobing 1 : 1/2-lobing 2 : 1/2 to 2/3-lobing 7 : 1/2 to 3/4-lobing 1 : 2/3-lobing 3 : 2/3 to 3/4-lobing 4 : 3/4-lobing 2 ; scale 1 : small scale 10 : boss 16 : none 1 ; blotch absent 28 ; petals overlapping 16 : not overlapping 12 ; segments overlapping 2 : not overlapping 26.

Sex : female 28.

Androecium : non-polliniferous anthers 7 ; petaloid staminodes 5.

Gynoecium : stigmata purple 13 : white 15 ; immature seeds purple 27.

Capsules : *S. maritima* type 20.

Mature seeds : armadillo 20.

Sterility : considerable with open pollination.

N. 315=N. 149 plant 7 x N. 148 plant 52. 18 plants in the family.

Habit : compact base 8, loose 10, erect 1, suberect 12, subprostrate 4 ; overwintering barren shoots present in considerable numbers ; stems up to 4·8 dm.

Surface : all glabrous and mat.

Leaves : M 1 : HM 3 : MH 6 : H 3 : GH 5.

Anthocyanin in vegetative parts : medium 8 : little 9 : none 1.

Inflorescence : number of flowers 5/2, 6/4, 7/7, 9/3, 13/1.

Calyx : large inflated 2 : inflated 4 : subinflated 11 ; anthocyanin medium 11 : little 6.

Corolla : Marguerite Yellow 5 : white 12 ; petals entire 3 : bilobed 10 ; multilobed 1 ; entire 3 : entire to emarginate 1 : emarginate 2 : emarginate to 1/4-lobing 2 : emarginate to 1/2-lobing 1 : 1/4 to 1/3-lobing 2 : 1/3 to 2/3-lobing 2 : 1/2 to 2/3-lobing 1 : 1/2 to 3/4-lobing 1 ; boss 7 : none 8 ; blotch present 1 : absent 16 ; petals overlapping 1 : not overlapping 16 ; segments not overlapping 11.

Sex : hermaphrodite 1 : hermaphrodite and female 1 : female 15.

Androecium : filaments purple 2 ; anthers purple 2 ; non-polliniferous anthers 2 ; petaloid staminodes 7.

Gynoecium : stigmata purple 8 : white 9 ; immature seeds purple 12 : white 5.

Capsules : *S. maritima* type 18.

Mature seeds : armadillo 18.

Sterility : not marked with open pollination.

N. 154=*S. glareosa* emarginate variant K. 1099 plant 41 x *S. vulgaris* (Loch Tay) S.P.B. 37. 63 plants in the family.

Habit : all spreading and subprostrate ; all died down with no over-wintering barren shoots except 11 showed a little green ; stems up to 5·0 dm.

Surface : all glabrous, all mat.

Leaves : more or less intermediate with a preponderance of *S. vulgaris* characters.

Anthocyanin in vegetative parts : medium 63.

Inflorescence : from 15 to 56 flowers.

Calyx : inflated 14 : subinflated 49 ; anthocyanin medium 63.

Corolla : Dy 24 : My 7 : Py 4 : MY 29 ; of the 31 Dy and My plants 14 had MY tips ; petals not multilobed ; entire 36 ; emarginate 18 : 1/3-lobing 4 : 1/2-lobing 5 ; boss 12 : no boss 51 ; no anthocyanin blotch present in the 29 MY plants ; petals and segments not overlapping 63.

Sex : hermaphrodite 1 : hermaphrodite and female 3 : female 59.

Androecium : filaments purple 4 : anthers purple 4 ; non-polliniferous anthers 4 ; petaloid staminodes 34.

Gynoecium : stigmata purple 63 ; immature seeds white 63.

Capsules : of intermediate type 58 : of *S. vulgaris* type 5.

Mature seeds : tubercled 1 : weak tubercled 5 : armadillo 38 : weak armadillo 19.

Sterility : not marked with open pollination.

With controlled pollination :

N. 154 plant	Total seeds	Capsules in which seeds counted	Average per capsule
25 selfed	330	12	27·5
23 x 25	132	3	44·0
49 x 25	67	2	33·5
28 x 25	143	4	35·75

N. 154 plant	Total seeds	Capsules in which seeds counted	Average per capsule
23 x N. 121/3	188	5	37·6
27 x N. 121/3	307	4	76·75
28 x N. 121/3	382	11	34·72
Selfings or crosses of which the seed was not viable :			
N. 297/5 selfed	36	3	12
N. 302/28 selfed	1	1	1
N. 313/49 selfed	86	2	43
N. 314/25 selfed	9	4	2·25
N. 279/32 x 25	101	3	33·66
N. 280/32 x 25	101	11	9·18
N. 292/27 x 25	254	5	50·8
N. 306/49 x 25	163	5	32·6
N. 308/27 x 25	405	10	40·5

N. 154 plant 25 had calyx subinflated, petals My, emarginate, no boss, hermaphrodite and female flowers, no petaloid staminodes, capsules intermediate, seeds armadillo.

N. 154 plant 23 had calyx inflated, petals MY, entire, no boss, female flowers, petaloid staminodes, capsules intermediate, seeds armadillo.

N. 154 plant 49 had calyx subinflated, petals Dy, entire, no boss, female flowers, petaloid staminodes, capsules intermediate, seeds armadillo.

N. 154 plant 28 had calyx subinflated, petals Py, 1/2 to 2/3-lobing, boss, female flowers, non-polliniferous anthers, capsules intermediate, seeds weak tubercled.

N. 154 plant 27 had calyx subinflated, petals Dy, entire, more or less acute, no boss, female flowers, petaloid staminodes, capsules of *S. vulgaris* type, seeds armadillo.

B. 37 (see K.B. 1940 p. 67) : *S. vulgaris* habit and leaves, compact, medium anthocyanin in vegetative parts, glabrous, up to 15 flowers, calyx subinflated with medium anthocyanin, petals bilobed, 3/4-lobing, petals and segments not overlapping, boss, colour M, hermaphrodite, filaments, anthers, and stigmata purple, immature seeds white, capsules *S. vulgaris* type, seeds tubercled.

N. 121 plant 3 : *S. vulgaris* habit and leaves, compact, medium anthocyanin in vegetative parts, glabrous, mat, up to 30 flowers, calyx subinflated with little anthocyanin, petals bilobed, 3/4-lobing, petals and segments not overlapping, boss, colour M, hermaphrodite, filaments, anthers, and stigmata purple, immature seeds white, capsules *S. vulgaris* type, seeds tubercled.

N. 277=N. 154 plant 25 selfed. 12 plants in the family.

Habit : erect 2 : suberect 10 ; spreading 10 : compact 2 ; no overwintering barren shoots ; stems up to 6·1 dm.

Surface : all glabrous, all mat.

Leaves : of *S. vulgaris* type, 2·8 cm. long and 0·6 cm. broad to 4·0 cm. long and 1·0 cm. broad.

Anthocyanin in vegetative parts : medium 12.

Inflorescence : 7 to 9 flowered.

Calyx : subinflated 12 ; anthocyanin medium 10 : little 2.

Petals : Dy 1 : My 9 : Py 1 : MY 1 ; 2 My had MY tips ; no petals multilobed ; entire 2 : entire to emarginate 1 : emarginate 1 : emarginate to 1/4-lobing 1 : 1/4-lobing 1 : 1/4 to 1/3-lobing 1 : 1/4 to 1/2-lobing 2 : 1/3 to 1/2-lobing 1 : 1/2-lobing 1 : 1/2 to 2/3-lobing 1 ; boss 8 : no boss 3 ; petals and segments not overlapping.

Sex : hermaphrodite 2 : hermaphrodite and female 3 : female 7.

Androecium : filaments purple 4 : white 1 ; anthers purple 5 ; non-polliniferous anthers 1 ; petaloid staminodes 2, in plant 2 they were My colour and the petals were entire and acute.

Gynoecium : stigmata purple 12 ; immature seeds white 12.

Capsules : *S. vulgaris* type 3 : intermediate type 8.

Mature seeds : armadillo 9.

Sterility : shown by some plants with open pollination.

Note. In the 1939–40 winter, out of 54 plants, 42 died.

N. 229=N. 154 plant 23 x N. 154 plant 25. 66 plants in the family.

Habit : erect 13 : suberect 51 : prostrate 1 ; spreading 2 : subspreading 51 : compact 12 ; no overwintering barren shoots ; stems up to 6·8 dm.

Surface : all glabrous and mat.

Leaves : G 3 : HG 6 : GH 29 : H 21 : VH 4 : HV 2 : V 1.

Anthocyanin in vegetative parts : much 3 : medium 42 : little 21.

Inflorescence : number of flowers 6/1, 7/2, 8/1, 9/2, 11/2, 12/4, 14/5, 15/6 16/2, 17/3, 18/5, 19/2, 20/4, 21/4, 22/2, 24/1, 25/4, 26/1, 27/2, 28/3, 30/1, 31/1, 33/4, 34/1, 38/1, 41/1.

Calyx : inflated 31 : subinflated 34 ; anthocyanin medium 36 : little 29.

Corolla : Dy 21 : My 14 : Py 1 : MY 26 : W 3 ; no petals multilobed ; entire 32 : emarginate 20 : 1/3-lobing 2 : 1/3 to 1/2-lobing 1 : 1/2-lobing 3 : 2/3-lobing 1 : 3/4-lobing 1 ; boss 12 : no boss 53 ; two MY plants had anthocyanin blotch ; petals overlapping 3 : not overlapping 62 ; segments not overlapping ; plant 2 with entire petals had acute petals.

Sex : hermaphrodite 7 : hermaphrodite and female 8 : female 50.

Androecium : filaments purple 15 ; anthers purple 15 ; non-polliniferous anthers 5 ; petalid staminodes 14, 2 plants with Dy petals had Dy petaloid staminodes and one (plant 61) had some of the staminodes emarginate though the petals were entire, and 2 other plants with Dy petals had the petaloid staminodes tinged with colour at the tips ; and 1 plant with MY petals had the petaloid staminodes tinged with colour on the back.

Gynoecium : stigmata purple 65 ; immature seeds white 64.

Capsules : *S. maritima* type 10 : intermediate type 32 : *S. vulgaris* type 6.

Mature seeds : armadillo 48.

Sterility : not marked with open pollination.

N. 301=N. 154 plant 49 x N. 154 plant 25. 67 plants in the family.

Habit : erect 4 : suberect 62 ; spreading 60 : subcompact 1 : compact 5; no overwintering barren shoots ; stems up to 7·3 dm.

Surface : all glabrous and mat.

Leaves : all *S. vulgaris* type.

Anthocyanin in vegetative parts : medium 67.

Inflorescence : number of flowers 5 to 15.

Calyx : inflated 20 : subinflated 47 ; anthocyanin much 4 : medium 52 : little 11.

Corolla : Dy 29 : My 25 : MY 13 ; petals no multilobing ; entire 26 : entire to emarginate 3 : emarginate 9 : emarginate to 1/4-lobing 6 : emarginate to 3/4-lobing 1 : 1/4-lobing 1 : 1/4 to 1/3-lobing 7 : 1/4 to 1/2-lobing 1 : 1/4 to 2/3-lobing 1 : 1/3 to 1/2-lobing 2 : 1/3 to 2/3-lobing 1 : 1/3 to 3/4-lobing 2 : 1/2-lobing 2 : 1/2 to 2/3-lobing 2 : 2/3 to 3/4-lobing 1 ; boss 29 : no boss 38 ; 1 MY had anthocyanin blotch ; petals and segments not overlapping ; 9 plants with entire petals had acute petals ; 12 Dy or My plants had the petals tipped MY.

Sex : hermaphrodite 5 : hermaphrodite and female 14 : female 48.

Androecium : filaments purple 16 : white 3 ; anthers purple 19 ; non-polliniferous anthers 7 ; petaloid staminodes 19 ; 6 Dy and 6 My and 1 MY plants had colour in the staminodes ; 1 Dy and 2 My plants had staminodes with specks of colour.

Gynoecium : stigmata purple 60 : white 7 ; immature seeds white 67.

Capsules (37 samples only) : *S. vulgaris* type 9 : intermediate type 28.

Mature seeds : armadillo 40 : weak armadillo 1.

Sterility : shown by some plants with open pollination.

N. 304=N. 154 plant 28 x N. 154 plant 25. 50 plants in the family.

Habit : erect 9 : suberect 38 : subprostrate 3 ; spreading 30 : subspreading 1 : compact 11 : subcompact 8 ; no overwintering barren stems ; stems up to 6·7 dm.

Surface : all glabrous and mat.

Leaves : all *S. vulgaris* type.

Anthocyanin in vegetative parts : much 50.

Inflorescence : number of flowers 5 to 23.

Calyx : inflated 13 : subinflated 37 ; anthocyanin much 46 : little 4.

Corolla : Dy 14 : My 22 : Py 4 : MY 10 ; petals multilobed 4 ; entire 18 : entire to emarginate 2 : emarginate 6 : emarginate to 1/3-lobing 2 : emarginate to 1/4-lobing 3 : emarginate to 1/2-lobing 1 : 1/4-lobing 1 : 1/4 to 1/3-lobing 1 : 1/4 to 1/2-lobing 3 : 1/4 to 2/3-lobing 1 : 1/3 to 1/2-lobing 1 : 1/3 to 2/3-lobing 1 : 1/2 to 3/4-lobing 2 : 3/4-lobing 7 ; boss 23 : no boss 25 ; no anthocyanin blotch ; petals and segments not overlapping ; acute petals 8 ; 1 Dy and 3 My petals were tipped MY.

Sex : hermaphrodite 4 : hermaphrodite and female 8 : female 38.

Androecium : filaments purple 12 ; anthers purple 12 ; non-polliniferous anthers 12 ; petaloid staminodes 12 ; 2 Dy, 1 My, 1 Py, and 1 MY had colour in the staminodes.

Gynoecium : stigmata purple 50 ; immature seeds white 50.

Capsules : *S. vulgaris* type 15 : intermediate type 32.

Mature seeds : armadillo 33 : weak armadillo 14.

Sterility : occurred in some plants with open pollination.

N. 293=N. 154 plant 23 x N. 121 plant 3. 59 plants in the family.

Habit : suberect 55 ; prostrate 1 : subprostrate 3 ; spreading 59 ; no overwintering barren stems ; stems up to 7·1 dm.

Surface : all glabrous and mat.

Leaves : all *S. vulgaris* type.

Anthocyanin in vegetative parts : not scored.

Inflorescence : number of flowers 15 to 32.

Calyx : inflated 40 : subinflated 18 ; anthocyanin medium 18 : little 40.

Corolla : Dy 4 : My 22 : Py 4 : MY 28 ; no petals multilobed ; entire 43 : entire to emarginate 5 : emarginate 8 : 1/4-lobing 2 ; boss 8 : no boss 50 ; anthocyanin blotch in 13 MY plants ; petals and segments not overlapping ; acute petals 4 ; 12 petals tipped MY ; one plant with MY petals had these coloured at the tip.

Sex : hermaphrodite and female 3 : female 55.

Androecium : filaments purple 3 : anthers purple 3 ; non-polliniferous anthers 7 ; petaloid staminodes 21 ; two with My petals had petaloid staminodes speckled with colour ; 3 Dy, 8 My, and 1 Py had flush colour in the staminodes.

Gynoecium : stigmata purple 58 ; immature seeds white 52.

Capsules : *S. vulgaris* type 49 : verging towards intermediate type 6.

Mature seeds : armadillo 52.

Sterility : not marked with open pollination.

N. 294=N. 154 plant 27 x N. 121 plant 3. 52 plants in the family.

Habit : erect 3 : suberect 4 : subprostrate 9 ; spreading 7 : subspreading 42 : compact 3 ; no overwintering barren shoots ; stems up to 6·6 dm.

Surface : all glabrous and mat.

Leaves : HG 4 : GH 14 : H 25 : VH 6 : HV 1 : V 2.

Anthocyanin in vegetative parts : much 2 : medium 42 : little 8.

Inflorescence : number of flowers 12 to 65 (no definite mode).

Calyx : inflated 11 : subinflated 41 ; anthocyanin medium 52.

Corolla : Dy 17 : My 11 : MY 24 ; no petals multilobed ; entire 43 : emarginate 9 ; boss 1 : no boss 51 ; anthocyanin blotch present in 3 MY plants ; no overlapping of petals or segments ; acute petals 1.

Sex : female 52.

Androecium : petaloid staminodes 43 ; of these 8 Dy plants, 1 My plant had anthocyanin colour in the staminodes.

Gynoecium : stigmata purple 48 : white 4 ; immature seeds white 48.

Capsules : *S. vulgaris* type 48 : verging to intermediate 1.

Mature seeds : armadillo 49.

Sterility : not marked with open pollination.

N. 295=N. 154 plant 28 x N. 121 plant 3. 66 plants in the family.

Habit : erect 4 : suberect 61 : subprostrate 1 ; spreading 64 : subcompact 1 : compact 1 ; no overwintering barren shoots ; stems up to 6·0 dm.

Surface : all glabrous and mat.

Leaves : all *S. vulgaris* type.

Anthocyanin in vegetative parts : medium 66.

Inflorescence : number of flowers 18 to 49.

Calyx : inflated 24 : subinflated 42 ; anthocyanin medium 34 : little 32.

Corolla : Dy 17 : My 25 : Py 4 : MY 20 ; no petals multilobed ; entire 9 : entire to emarginate 14 : emarginate 18 : emarginate to 1/4-lobing 3 : 1/4-lobing 6 : 1/4 to 1/2-lobing 2 : 1/4 to 1/3-lobing 2 : 1/3 to 1/2-lobing 3 : 1/3 to 3/4-lobing 1 : 1/2-lobing 2 : 1/2 to 2/3-lobing 5 : 1/2 to 3/4-lobing 1 ; boss 19 : no boss 47 ; anthocyanin blotch present in 3 MY plants ; no overlapping of petals and segments ; no acute petals ; 14 petals tipped MY.

Sex : hermaphrodite and female 5 : female 61.

Androecium : filaments purple 5 ; anthers purple 5 ; non-polliniferous anthers 16 ; petaloid staminodes 36 ; of these 1 Dy and 3 My showed a flush of colour in the staminodes and 1 Dy and 2 My showed specks of colour in the staminodes.

Gynoecium : stigmata purple 65 : white 1 ; immature seeds white 63.

Capsules : *S. vulgaris* type 58 and 2 verging to intermediate.

Mature seeds : weak tubercled : 25 : armadillo 24 : weak armadillo 10.

Sterility : not marked with open pollination.

N. 155=*S. glareosa* emarginate variant K. 1099 plant 41 x *S. vulgaris* N. 12 plant 251. 46 plants in the family.

Habit : all spreading and subprostrate ; all died down and no overwintering barren shoots ; stems up to 7·5 dm.

Surface : all glabrous, all mat.

Leaves : intermediate.

Anthocyanin in vegetative parts : much 34 : medium 12.

Inflorescence : from 7 to 49 flowered.

Calyx : inflated 46 ; anthocyanin medium 46.

Corolla : Marguerite Yellow 46 ; no multilobed petals ; entire 10 : emarginate 16 : 1/4-lobing 4 : 1/3-lobing 4 : 1/2-lobing 1 : 1/2 to 3/4-lobing 1 : 2/3-lobing 5 ; 3/4-lobing 4 ; boss 25 : no boss 20 ; no anthocyanin blotch ; petals and segments not overlapping.

Sex : hermaphrodite 5 : hermaphrodite and female 2 : female 38.

Androecium : filaments purple 7 ; anthers purple 7 ; non-polliniferous anthers 7 ; petaloid staminodes 16.

Gynoecium : stigmata purple 41 : white 4 ; immature seeds white 46.

Capsules : intermediate 45.

Mature seeds : armadillo 38 : weak armadillo 7.

Sterility : not marked with open pollination.

N. 155 plant 30. Anthocyanin in vegetative parts medium, petals 1/2 to 3/4-lobing, boss, hermaphrodite, stigmata purple, seeds armadillo.

N. 155 plant 36. Anthocyanin in vegetative parts much, petals 2/3 to 3/4-lobing, boss, hermaphrodite, stigmata purple, seeds armadillo.

N. 155 plant 1. Anthocyanin in vegetative parts much, petals entire, no boss, female, petaloid staminodes, stigmata white, seeds armadillo.

N. 12 plant 251. *S. vulgaris* for habit and leaves, with little anthocyanin, few hairs, calyx inflated with some anthocyanin, hermaphrodite, boss, filaments, anthers and stigmata purple, immature seeds white, *S. vulgaris* type capsule, seeds armadillo.

With controlled pollination :

N. 155 plant	Total seeds	Capsules in which seeds counted	Average per capsule
30	178	6	29·66
36	456	11	41·45
1 x 30	220	3	73·33
1 x 36	1033	22	46·95

N. 290=N. 155 plant 30 selfed. 17 plants in the family.

Habit : suberect 10 : subprostrate 6 : prostrate 1 ; spreading 14 : subspreading 3 ; no overwintering barren shoots ; stems up to 6·7 dm.

Surface : all mat ; indumentum stems and leaves glabrous 17 ; inflorescence branches few 3 : very few 1 : glabrous 13.

Leaves : all *S. vulgaris* type.

Anthocyanin in vegetative parts : medium 7 : little 8.

Inflorescence : number of flowers 10 to 53.

Calyx : inflated 12 : subinflated 5 ; anthocyanin medium 13 : little 3.

Corolla : white 17 ; petals bilobed 17 ; emarginate 1 : emarginate to 1/3-lobing 1 ; 1/4-lobing 1 ; 1/4 to 1/3-lobing 2 : 1/2-lobing 1 : 1/2 to 2/3-lobing 1 : 1/2 to 3/4-lobing 2 : 2/3 to 3/4-lobing 4 : 3/4-lobing 4 ; boss 14 : no boss 3 ; anthocyanin blotch absent 17 : petals and segments not overlapping 17.

Sex : hermaphrodite 7 : female 10.

Androecium : filaments purple 6 ; anthers purple 6 ; non-polliniferous anthers 6 ; petaloid staminodes 1.

Gynoecium : stigmata purple 16 ; immature seeds white 14.

Capsules : *S. vulgaris* type 3 : intermediate 12.

Mature seeds : armadillo 15.

Sterility : not marked with open pollination. 23 out of 40 plants died in the winter 1939–40.

N. 310=N. 155 plant 36 selfed. 4 plants in the family.

Habit : suberect 4 ; spreading 2 : subspreading 2 ; no overwintering barren shoots ; stems up to 3·6 dm.

Surface : all mat and glabrous.

Leaves : all *S. vulgaris* type.

Anthocyanin in vegetative parts : medium 4.

Inflorescence : number of flowers 6 to 25.

Calyx : inflated 2 : subinflated 2 ; anthocyanin medium 4.

Corolla : MY 2 : W 2 ; bilobed 4 ; 1/2 to 2/3-lobing 2 : 2/3-lobing 1 : 2/3 to 3/4-lobing 1 ; boss 4 ; anthocyanin blotch absent 4 ; petals overlapping 1 : not overlapping 3 ; segments not overlapping 4.

Sex : hermaphrodite 1 : female 3.

Androecium : filaments purple 1 ; anthers purple 1 ; non-polliniferous anthers 3 ; no petaloid staminodes.

Gynoecium : stigmata purple 4 ; immature seeds white 3.

Capsules : intermediate type 2.

Mature seeds : armadillo 1.

Sterility : seed production poor. 11 plants died in the 1939–40 winter.

N. 298=N. 155 plant 1 x N. 155 plant 30. 30 plants in the family.

Habit : subprostrate 13 : prostrate 17 ; spreading 30 ; no overwintering barren shoots ; stems up to 7·7 dm.

Surface : all glabrous and mat.

Leaves : G 1 : HG 3 : GH 9 : H 14 : VH 3.

Anthocyanin in vegetative parts : much 10 : medium 20.

Inflorescence : number of flowers 8 to 70.

Calyx : inflated 19 : subinflated 11 ; anthocyanin medium 30.

Corolla : MY 27 : W 3 ; no petals multilobed ; entire 1 : emarginate 12 : 1/3-lobing 6 : 1/2-lobing 3 : 2/3-lobing 5 : 3/4-lobing 3 ; small scale 2 : boss 13 : no boss 15 ; anthocyanin blotch absent 30 ; petals overlapping 4 : not overlapping 25 ; segments not overlapping.

Sex : hermaphrodite 10 : hermaphrodite and female 1 : female 19.

Androecium : filaments purple 8 : white 2 ; anthers purple 10 ; non-polliniferous anthers 0 ; petaloid staminodes 8.

Gynoecium : stigmata purple 12 : white 18 ; immature seeds purple 2 : white 28.

Capsules : *S. maritima* type 2 : intermediate 22 : *S. vulgaris* type 5.

Mature seeds : armadillo 27 : weak armadillo 1.

Sterility : not marked with open pollination.

N. 309=N. 155 plant 1 x N. 155 plant 36. 2 plants in the family.

Habit : suberect 1 : subprostrate 1 ; spreading 2 ; no overwintering barren shoots ; stems up to 5·3 dm.

Surface : glabrous and mat.

Leaves : *S. vulgaris* type.

Anthocyanin in vegetative parts : much 2.

Inflorescence : number of flowers 27 and 30.

Calyx : inflated 1 : subinflated 1 ; anthocyanin medium 2.

Corolla : MY 2 ; no petals multilobed ; 1/3 to 2/3-lobing 1 : 1/2 to 2/3-lobing 1 ; boss 2 ; anthocyanin blotch absent ; petals and segments not overlapping.

Sex : female 2.

Androecium : non-polliniferous anthers 2.

Gynoecium : stigmata purple 2 ; immature seeds white 2.

Capsules : *S. maritima* type 1 : intermediate 1.

Mature seeds : armadillo 2.

Sterility : not marked with open pollination. 14 plants died in the 1939–40 winter.

Discussion and conclusions.

The crosses considered in this section involve a plant of *S. glareosa* with slightly emarginate petals and staminodes replacing stamens. In *S. maritima* and *S. vulgaris* petals are generally bilobed with the lamina 3/4 (more rarely 2/3) lobed. In both these species flowers functionally female (male sterile) are of fairly common occurrence. In such functionally female flowers the stamens are reduced to mere vestiges not, as in the *S. glareosa* plant referred to above, developed as more or less petaloid staminodes. The petals of the *S. glareosa* plant were Marguerite Yellow in colour. These characters (petal shape, petal colour, and the presence of petaloid staminodes) were new ones to our series of researches and it appeared possible that by breeding from this plant some additional information could be obtained regarding the genetics of petal lobing and sex in the bladder campions. Since the *S. glareosa* plant was functionally

a complete female (male sterile) reciprocal crosses could not be made but nine different plants were used as pollen parents in the experiments outlined above. Six of these were used to pollinate *S, glareosa*, K. 1099 plant 41, directly. The results show clearly that the characters mentioned above have a genetic basis.

The genetic behaviour of characters, other than the special ones, followed, in general, results obtained in previously recorded breeding work and there is no need here to consider in detail habit, indumentum, leaf shape, anthocyanin occurrence and distribution (apart from petal colour), calyx and capsule shapes, and testa surface.

Petal Colour.

(see p. 35 for key to symbols).

None of the plants used as pollen parents had Marguerite Yellow (MY) petals and no petals of this colour had appeared when they were used in selfings or crossings other than those recorded here. Marguerite Yellow colour and Marguerite Yellow background was introduced genetically from *S. glareosa* K. 1099 plant 41, the ovule parent in all the F_1 crossings. The following are summated results :

(1) F_1 families with four different *S. maritima* pollen parents with W petals :

N. 146 gave	MY 15	: W 60
N. 147 ,,	MY 23	: W 54
N. 148 ,,	MY 11	: W 66
N. 149 ,,	MY 22	: W 67
Totals	71	: 247=1 : 3·48.

(2) F_1 family with *S. vulgaris* Loch Tay with M coloured petals as pollen parent :

N. 154 gave MY 29 : coloured 35.

Of the coloured petals at least 14 had MY tips and all had MY background.

(3) F_1 family with *S. vulgaris* as pollen parent with W petals :

N. 155 gave MY 46 : W 0.

(4) F_2 families and others involving *S. maritima* :

(a) Selfings of F_1 plants with W petals :

N. 274 gave	MY 0	: W 7
N. 275 ,,	MY 5	: W 14
N. 276 ,,	MY 1	: W 18
N. 268 ,,	MY 1	: W 14
N. 269 ,,	MY 16	: W 20
N. 278 ,,	MY 1	: W 3
Totals	24	: 76 =1 : 3·17.

(b) Two F_1 plants with white petals crossed :

N. 300 gave MY 12 : W 17

(c) An F_1 plant with W petals crossed with *S. maritima* :

N. 271 gave MY 36 : W 31
N. 307 ,, MY 9 : W 7

(d) Selfings of F_1 plants with W petals :

N. 272 gave MY 21 : W 39
N. 273 ,, MY 5 : W 19
N. 282 ,, MY 12 : W 19
N. 283 ,, MY 8 : W 35
N. 320 ,, MY 6 : W 5

Totals 52 : 117=1 : 2·25.

(e) Selfings of F_1 plants with W petals :

N. 270 gave MY 2 : W 11
N. 321 ,, MY 0 : W 13

(f) An F_1 plant with MY petals crossed with *S. maritima* :

N. 281 gave MY 0 : W 48
N. 305 ,, MY 0 : W 10
N. 312 ,, MY 0 : W 28

(g) Two F_1 plants of different parentage crossed together :

N. 315 gave MY 5 : W 12

(h) An F_1 plant with W petals crossed with *S. maritima* :

N. 291 gave MY 0 : W 10
N. 303 ,, MY 0 : W 21

Families under (f), (g), and (h) all involved *S. maritima* N. 18 plant 11. Only one family (N. 315) out of six yielded any plants with MY petals.

(5) F_2 families and others involving *S. vulgaris* from Loch Tay with medium coloured petals :

N. 274 (selfing of F_1) gave 12 MY background.

N. 229 (two F_1 plants crossed together) gave 62 MY background: 2 W.

N. 301 (two F_1 plants crossed together) gave 67 MY background.

N. 304 (two F_1 plants crossed together) gave 50 MY background.

N. 293 (an F_1 plant crossed with another Loch Tay plant) gave 58 MY background.

N. 294 (as last) gave 52 MY background.

N. 295 (as last) gave 66 MY background.

These families (not all strictly comparable) gave a total of 369 MY background : 2 W.

(6) F_2 families involving *S. vulgaris* with white petals :

N. 290 (F_1 plant selfed) gave W 17.

N. 310 (F_1 plant selfed) gave MY 2 : W 2.

N. 298 (two F_1 plants crossed together) gave MY 27 : W 3.

N. 309 (two F_1 plants crossed together) gave MY 2.

Lobing of Petals.

Petal lobing in the plants here considered was difficult to score since there were often fluctuations on the same plant for different petals at the same or different dates. The results of our scoring are even more difficult to summarize. The following conclusions can be drawn :

1. While petal lobing is in some ways genetically controlled clear-cut segregation and ratios capable of simple Mendelian interpretation do not appear.

2. Every family (F_1, F_2, or backcross) shows segregation, the majority from entire or emarginate to 3/4-lobing.

3. While the entire or emarginate condition was introduced by *S. glareosa* K. 1099 plant 41, used as ovule parent, it is clear that the pollen parent is not without influence on the depth of lobing. Presumably, therefore, absence of or depth of lobing is not controlled by or only by maternal plasmagenes. There are striking differences in the ratios for individual F_1 and F_2 families which prove this. It is also evident by comparing the results of using *S. maritima* as pollen parent with those obtained when *S. vulgaris* was used. Thus, summating plants with entire and/or emarginate petals with those with petals showing 3/4-lobing we obtain the following figures :

	entire to emarginate	3/4-lobing
S. maritima as pollen parent (F_1 families) ...	85	64
S. vulgaris (Loch Tay) as pollen parent (F_1 families)	54	0
S. vulgaris as pollen parent (F_1 families) ...	26	4
S. maritima as pollen grandparent (F_2 families)	143	127
S. vulgaris (Loch Tay) as pollen grandparent (F_2 families)	286	16
S. vulgaris as pollen grandparent (F_2 families)	15	14

4. The evidence from fluctuations may be interpreted as due to only partial control by chromosomal genes.

Sex.

By hermaphrodite (H) is here meant that all flowers examined had functional ovules and functional pollen ; by female (F) is meant that all flowers examined had functional ovules but no functional pollen, whatever the state of development of the stamens (or staminodes) ; by hermaphrodite and female (HF) is meant that on the one plant there were hermaphrodite and female flowers as defined above.

Difficult as the results are to interpret in detail it is evident that the sex condition is in part at least genetically controlled. The very different ratios obtained when different pollen parents are used with the same ovule parent indicate this. F_1 families, all with K. 1099 plant 41 as the ovule parent but every one with a different pollen parent, gave the following results :

N. 146 H 11 : HF 3 : F 61
N. 147 H 16 : HF 1 : F 60
N. 148 H 43 : HF 0 : F 34
N. 149 H 31 : HF 11 : F 47
N. 154 H 1 : HF 3 : F 59
N. 155 H 5 : HF 2 : F 38

Striking differences also occur in F_2 families and backcrosses. Summations of F_2 families and backcrosses from the above F_1 families give the following figures :

From N. 146 H 17 : HF 2 : F 26
,, N. 147 H 21 : HF 41 : F 105
,, N 148 H 52 : HF 7 : F 101
,, N. 149 H 3 : HF 3 : F 154
,, N. 154 H 26 : HF 33 : F 311
,, N. 155 H 18 : HF 1 : F 34

Very marked are the differences in the ratios of F_2 families from N. 149 from those from N. 146, 147, and 148, although all four had *S. maritima* grandparents but belonging to different stocks.

It should be noted that plants were scored for sex generally at maximum anthesis in one season only. This meant that only flowers then in bloom were examined. It is possible that some plants scored as H or F would be scored HF if it had been possible to score every flower over several seasons.

We have found no male plants (gynoecium deficient or non-functional) in either wild populations or bred families. Similarly we have found no morphological neuters. On the other hand, the androecium abnormalities which result in the female as distinct from the hermaphrodite condition are of at least three kinds. First, vestigial stamens, very few mm. in length, around the base of the ovary. This is the common kind and is found widely in *S. maritima* and *S. vulgaris*. Secondly, " non-polliniferous stamens ", in which the filaments are normally developed but the anthers contain no viable pollen. Thirdly, with petaloid (or more or less petaloid) staminodes. This last is the rarest condition in our experience. All three kinds of abnormal androecium may show fluctuations in one and the same plant or in one and the same flower. There are, however, individual plants which were " fixed females " in that one or other of the three states of abnormal androecium appeared in every one of the 10 organs occupying the position of stamens, in every flower of the plant, throughout a season, and for all seasons during which the plant was under observation. For example, this was true for K. 1099 plant 41.

In the F_1 and F_2 families involving *S. glareosa* K. 1099 plant 41 all the three types of abnormalities mentioned above, as well as intergrades, appeared. It is, therefore, probable that they are genetically related one to another. There is also some connection between petal morphology and the degree and kind of stamen or staminode development. Thus, hermaphrodite flowers have larger petals than female ones that are genetically otherwise similar. This is sometimes well seen in plants with both hermaphrodite and female flowers. On the whole, as in K. 1099

plant 41, in the series of families dealt with above flowers with petaloid staminodes have emarginate (or entire), or at least not deeply bilobed, petals that are Marguerite Yellow in colour. These facts suggest that some at least of the special gene complexes acting on the development of the androecium also act on the development of the corolla. This may be genetical evidence in favour of those theories deriving petals from stamens in some families at least.

The not infrequent occurrence of HF plants and the occurrence of flowers with 1 to 9 stamens producing viable pollen can only be explained by some kind of somatic differentiation, whether this be somatic segregation in any Mendelian sense or the result of cytoplasmic factors unequally distributed, or both. The cytoplasmic factors, if such there be, may be environmental in nature or action rather than plasmagenes acting directly on organ primordia. They may also be dependent for their action on a certain stage of ontogenetic development of the plant, of an inflorescence, or even of a flower. To this extent there may be a time control.

The suggestion therefore, is made that a basic gene set, chromosomal in location and thus under control in a normal Mendelian manner, is primarily responsible for production of the sex organs. Such a set may be of the MMFF type. Superimposed on the potentialities of this basic set genes acting as retarders of stamen development and (rarely) others which modify stamens to petaloid staminodes may be present. Some, if not all, the retarding and modifying genes are probably located in the cytoplasm.

Summary.

1. In this paper are described the results of genetical studies on material of *Silene glareosa* and *S. alpina* from the French Alps. Stock plants and the results of selfings and intrataxic crossings are described. Crosses were also made between both of these taxa and British *S. maritima* and *S. vulgaris* and Norwegian *S. vulgaris*.

2. *Habit. S. glareosa* and *S. alpina* were both hemicryptophytic. Genes for the chamaephytic habit were introduced by crossing each of these with *S. maritima*. Expression and segregation of this character pair was not clear-cut, partly because a number of genes of small single effect are probably involved and partly because of an overlap in the influence of genetic and environmental factors. All *S. glareosa* plants used as stock plants were glabrous. A short bristly type of indumentum occurred in most *S. alpina* plants used in breeding. This had a genetic basis and there was segregation in families when such plants were used as either male or female parents. Usually the segregation involved both presence and absence of hairs and, if they were present, their density of development. Glabrous *S. alpina* bred true to the glabrous character when crossed with *S. glareosa* reciprocally. Shining green surface is recessive to mat. Genes for this character were introduced in some crosses by using a plant (N. 12/219) which was heterozygous for mat and shining green surface. The recessive character appeared in a small number of F_2 individuals.

3. *Leaves.* Leaf shape is controlled genetically by a large number of genes. Very often F_1 plants are intermediate in shape or show a tendency

for narrowness to be more or less dominant. Segregation generally occurs in F_2.

4. *Inflorescence.* *S. maritima*, *S. glareosa*, and *S. alpina* have very few (1 to 7) flowered inflorescences. *S. vulgaris* has typically many (frequently 30 to 70) flowered inflorescences. F_1 between *S. vulgaris* and one of the other taxa mentioned is more or less intermediate and there is a range of segregation in F_2.

5. *Calyx.* Inflated, subinflated, narrow, and long cylindric calyces characterized various stock plants used for selfings and crosses. Segregations occurred in many F_1 and F_2 families for these shapes and for combinations of shapes. Some of the combinations gave new characters (e.g. in N. 269 and N. 278).

6. *Corolla.* In British *S. vulgaris* and *S. maritima* the petals at anthesis are most often white but purplish coloured variants have been investigated genetically (see K.B. 1940, 66 ; K.B. 1948, 264). Colour in the petals is much commoner in *S. alpina* and *S. glareosa.* A colour, Marguerite Yellow, new in petals at anthesis to the taxa with which we have worked, is described and sometimes occurred in combinations with the Laelia Pink series of colours of Loch Tay plants from which series it is genetically quite distinct. There was segregation between White and Marguerite Yellow except when the White flowered parent lacked anthocyanin in all parts except the immature seeds (N. 18 plant 11). In young buds of normally white flowered *S. maritima* and *S. vulgaris* the abaxial surface of the immature petals are Marguerite Yellow. Further, Marguerite Yellow is present, as a rule, in the petals at anthesis of female flowers not of hermaphrodite flowers, in offspring originating from the emarginate variant. These and other facts suggest that gene action here involves delay in development of petals and androecium relative to calyx and gynoecium.

The anthocyanin colour series showed segregation for presence and absence. How far intensity of colour, when present, is controlled genetically and how far environmentally and ontogenetically is uncertain.

One " poor petal " plant segregated in N. 275. Genes for this character were introduced by the grandparent S.P.A. 13.

Coronal development is very meagre in *S. glareosa* and *S. alpina* compared with typical *S. maritima.* In some plants of offspring families there was no detectable corona at all. The series from scale to boss and thence to total absence of corona is a continuous one and the scoring classes are arbitrary. There was, however, undoubted segregation in F_2, and some times in F_1, families.

Lobing of petals was studied in detail in the series of families involving the emarginate variant of *S. glareosa.* There were many fluctuations but the results prove an underlying genetic control with segregation of genes some, at least, of which were chromosal.

In spite of the reduction of flower number per inflorescence, flowers of of *S. glareosa* and *S. alpina* are zygomorphic. In the latter the flowers are usually not quite so strongly zygomorphic as the flowers of *S. vulgaris* but they are not erect and actinomorphic as in *S. maritima.*

Undoubtedly the best development of petals in the bladder campions we have used occurs in many stocks of *S. maritima*. In stocks of this taxon we have often : large deeply lobed petals, overlapping of petals and segments, multilobing, full coronal scales, and anthocyanin blotch. There is in the *S. glareosa* emarginate variant, and in plants derived from this, a general retardation of development in some or all of these characters

7. *Sex*. Tabulations of results obtained are given at the end of sections. In particular it is to be noted that very different ratios result when different pollen parents are used to pollinate the same plant as ovule parent. One other example of this may be given :

K. 1094/20	x K. 1099/8	gave	F 14
,,	x K. 1094/20	,,	F 10
,,	x K. 1095/14	,,	H 25
,,	x K. 1085/57	,,	F 2
,,	x S.P.A. 70	,,	F 66
,,	x N. 12/219	,,	H 13 : F 21
,,	x P. 1/11	,,	HF 1 : F 20

The facts given in this and other papers of the series prove that there are genes with sometimes partial, sometimes complete, control of " sex " expression. The potency of such genes may not always be the same and in addition to them there are probably modifying factors.

8. *Mature seeds*. Full armadillo was recessive to normal tubercled but in some families dealt with in this paper there were modifying factors present for testa characters, sometimes with unexpected consequences. In some capsules, for example, there was somatic segregation resulting in different types of seeds present in the same capsule (e.g. N. 176). Seed characters in the high mountain bladder campions were sometimes less clear-cut than in many British populations of *S. maritima* and *S. vulgaris* and the obscuring of class boundaries was still more marked in crosses between stocks of widely different geographical origin.

9. *Capsules*. *S. alpina* and *S. glareosa* have *S. maritima* type capsules which type was also common in high mountain *S. vulgaris*. The capsule characters are most often well differentiated in British populations of *S. maritima* and *S. vulgaris*, with F_1 intermediate. The *S. maritima* type of capsule was retained in crosses between *S. glareosa* or *S. alpina* and *S. maritima* but with *S. vulgaris* there was segregation for capsule shape.

10. *Sterility*. In the series of selfings and crosses recorded here, sterility is expressed either in failure to set seeds after pollination or in failure of apparently "good" seeds to germinate. A greater degree of sterility has been encountered in the pollinations here recorded than elsewhere in our work.

In *S. glareosa* and *S. alpina* there was a good deal of self-sterility in the sense that generally only small families were raised on selfing. On crossing *S. glareosa* and *S. alpina* together there was much sterility which was complete in F_2.

In *S. glareosa* x *S. maritima* sterility varied ; with some individual parents it was marked in F_2 not in F_1 ; with others it was inconsiderable ; in others, medium to large families were obtained only by pollinating large numbers of flowers.

In *S. alpina* x *S. maritima* sterility also varied. In F_1 it was not marked but occurred strongly in F_2 but rather less than the averages for F_2 in *S. glareosa* x *S. maritima.*

In *S. glareosa* x *S. vulgaris* sterility was generally not marked in F_1 but was more or less present in F_2 and very marked in F_2.

In *S. alpina* x *S. vulgaris* sterility was generally not marked in F_1 but was strongly present in F_3.

Crosses between sibs and back crosses sometimes partially renewed fertility.

One can sum up by saying that sterility was generally present when crosses between taxa were made, that its degree varied greatly, that it was most frequently incomplete (some viable seeds being set), and that it was usually more marked in F_2 than in F_1.

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RESEARCHES ON SILENE MARITIMA AND S. VULGARIS :— XXXIII.

E. M. Marsden-Jones and W. B. Turrill.

Studies of seedlings.

Seedlings representative of a large number of the families (selfings and crossings) that have been considered in this series were preserved for later comparative studies. For obvious reasons only very small numbers of seedlings could be abstracted from most families and no attempt was made to obtain ratios genetically significant. It should be noted that we have scored for lamina shape of cotyledons and that measurements are given in mm. for total length of a cotyledon including lamina and petiole. The cotyledon shapes are always closely correlated with the shape of the first two to three pairs of young foliage leaves, except that the apices are less acute and more obtuse or rounded. In the bladder campions the cotyledons have axillary buds which often very quickly grow out into well-formed elongating lateral branches.

There are two main shape types of cotyledons in the families dealt with here. These we call I and II and define them as follows :

I, blade oblong gradually narrowed into the petiole.

II, blade ovate-oblong to elliptic generally abruptly narrowed into the petiole.

S. maritima.

A. 7 x A. 12 (N. 21) : I, 14 x 4.

A. 20 x A. 12 (N. 19) A. 20 x A. 7 (N. 22), and A. 2 x A. 13 (N. 68) : are all I and showed no segregation.

A. 22 selfed (N. 55) : I, 18 x 6 ; selfings of N. 55 gave I, 20 x 6·5 and showed no obvious segregation.

A. 2 x A. 13 (N. 36) ; selfings of N. 36 (13 seedlings) : I, 18 x 5·5, no segregation.

A. 15 x A. 12 (N. 33) ; selfings of N. 33 (17 seedlings) : I, no segregation.

A. 70 selfed (N. 104) : (10 seedlings) narrow I, 22 x 5 ; selfings of N. 104 (9 seedlings) narrow I.

A. 5 selfed (N. 14) : narrow I, 24 x 3·5 ; A. 13 selfed (N. 16) : I, 18 x 4·5 ; A. 5 x A. 13 (N. 34) : I, 23 x 5·5 ; selfings of N. 34 gave narrow I, 22 x 4 and I, 23 x 4.

A. 15 selfed (N. 38) : narrow I, 14 x 2·5.

A. 1 selfed (N. 8) : I, 19 x 5.

A. 21 selfed (N. 46) : (12 seedlings) some segregation from I, 19 x 4·5 to II, 21 x 6·5.

A. 2 x A. 21 (N. 47) : (3 seedlings) I–II, 25 x 7 ; selfings of N. 47 (5 seedlings) showed segregation from I, 27·5 x 6 to II, 18·5 x 6.

P. 4 (Sweden) : (2 seedlings) I (slightly verging to I–II), 21 x 5 ; selfings of and crossings between P. 4 plants (40 seedlings) showed segregation from I, 19 x 4·5 to II, 22 x 7.

S. VULGARIS.

B. 5 selfed (N. 12) : (7 seedlings) I–II, 18·5 x 7 ; selfings of N. 12 (4 seedlings) gave I–II, 23·5 x 6·5.

B. 16 x B. 11 (N. 37) : II, 22 x 7·5 ; N. 37 selfed, II, no segregation.

B. 1 selfed (N. 9) : II, 17 x 5·5.

B. 38 selfed (N. 122), B. 39 selfed (N. 120), and selfings from N. 120, all II, 24 x 7 ; B. 37 selfed (N. 121) and N. 121 selfed gave I–II, 23 x 5·5.

P. 1 (Norway) : (2 seedlings) II, 24 x 7 ; selfing of P. 1 plant 11 (4 seedlings), II.

P. 2 (Switzerland) : II, 21 x 9 ; selfings of four P. 2 plants (10 seedlings) ranged from I–II to II.

P. 3 (Switzerland) : selfings of four P. 3 plants ranged from I–II to II.

N. 12 (B. 5 selfed) plant 219 x P. 1 (N. 216) (3 seedlings) II, 27 x 8 ; selfings of N. 216 plants (43 seedlings) gave a range from I, 17 x 3·5 to II, 17·5 x 6·5.

N. 12 plant 251 x B. 39 (N. 125) : (4 seedlings) II, 21 x 7·5 ; selfings of N. 125 plants : (12 seedlings) II.

P. 5, P. 6, P. 7, P. 8 (Pyrenees) : extreme II, 19 x 9·5 mm. Selfings to second generation (42 seedlings) gave only II or extreme II, 18 x 4·5 and 18 x 9·5.

B. 35 selfed (N. 23), B. 36 selfed (N. 56), and N. 56 selfed : extreme II, 13 x 8·5 and 20 x 10.

B. 5 x B. 39 (N. 125) : (4 seedlings) II, 21 x 7·5 ; N. 125 selfings (12 seedlings) II.

S. MARITIMA x S. VULGARIS (and reciprocal).

A. 15 x B. 11 (N. 40) : I–II, 22·5 x 8 ; N. 40 selfings : segregation into I, II, and I–II, ranges from 24 x 5·5 to 23·5 x 8, with intermediates averaging 23 x 6.

A. 2 x B. 11 (N. 42) : I–II (but broader than in N. 40), 25 x 8 ; N. 42 selfing (2 seedlings) I–II, 26 x 7·5.

B. 11 x A. 5 (N. 52) ; N. 52 selfings (6 seedlings) gave segregations : I, 26 x 4 (2 seedlings) and I–II, 28 x 6 (4 seedlings).

A. 1 x B. 1 (N. 4) ; N. 4 selfing (16 seedlings) : segregation with extremes I, 22·6 x 7 and II, 18·5 x 8·5.

B. 11 x A. 21 (N. 49) : I–II, 27 x 7·5 ; N. 49 selfings (5 seedlings) : I–II, 25 x 7.

A. 70 x N. 12 plants (N. 110, N. 111, N. 116) : (13 seedlings) I–II ; selfings of N. 110, N. 111, and N. 116 (31 seedlings) showed segregation from narrow I, 24 x 4·5 (as in A. 70) to II, 24 x 7.

N. 36 plant 8 x B. 37 (N. 123) : (8 seedlings) I–II, 26 x 7 ; selfings of No. 123 plants (16 seedlings) : segregation from I, 20 x 5 to II, 21 x 6.

A. 70 x B. 37 (N. 126) : (6 seedlings) I, 26 x 6·5 ; N. 126 selfings : (17 seedlings) I–II, 18·5 x 6.

A. 6 x B. 36 (N. 25) : I–II, 26·5 x 9 ; selfings of N. 25 gave segregation from I, 29 x 6 to II, 20 x 8.5.

S. GLAREOSA.

Selfings of stock plants and crossings together of two stock plants from French Alps : (18 seedlings) range from I, 17·5 x 3 to II, 18·5 x 6.

P. 9 (Tyrol) selfed (N. 206) : I, 11 x 3.

K. 1094 plant 11 x P. 9 (N. 201) : (1 seedling) I, 17 x 3.

S. ALPINA.

Selfings of stock plants and crossings together of two stock plants from French Alps (7 seedlings) : II, 16 x 6.

S. GLAREOSA x S. MARITIMA.

K. 1099 plant 32 x A. 20 (N. 163) : 3 seedlings) I, 21 x 4·5 ; selfing of N. 163 (1 seedling) I.

K. 1099 plant 32 x A. 68 (N. 167) : (3 seedlings) I–II (verging to I), 23 x 6 ; selfings of N. 167 : (6 seedlings) gave segregation I, 21 x 5 (2 seedlings), I–II, 22 x 6 (3 seedlings), II, 17 x 6 (1 seedling).

K. 1094 plant 20 x A. 70 (N. 210) : (5 seedlings) I–II (verging to II), 17 x 6.

K. 1099 plant 32 x A. 70 (N. 182) : (3 seedlings) I–II ; selfings of N. 182 : (7 seedlings) I–II, 25 x 6.

S. GLAREOSA x S. VULGARIS.

In 10 F_1 and F_2 families (41 seedlings) all II, 20 x 6·5. In one F_2 family (N. 367) (1 seedling) I, 20 x 3.

K. 1094 plant 20 x P. 1 plant 11 (Norway) (N. 215) : (2 seedlings) II, 17 x 8.

K. 1099 plant 46 x P. 1 plant 11 (Norway) (N. 218) : (2 seedlings) I–II, 24 x 6 ; selfings of N. 218 : (34 seedlings), range from I to I–II, 19 x 4·5 to 18 x 6.

N. 12 plant 219 x P. 9 (Tyrol) (N. 200) : (3 seedlings) II, 23 x 6.

S. ALPINA AND S. MARITIMA.

K. 1085 plant 5 x A. 20 (N. 162) : (4 seedlings) I–II, 19 x 6 ; N. 162 selfed (N. 323) (1 seedling) I–II, 22·5 x 6·5 ; N. 162 selfed (N. 332) (1 seedling) I, 20 x 3·5.

K. 1085 plant 24 x A. 68 (N. 168) : (3 seedlings) I–II, 23 x 6·5 ; selfings of N. 168 : (7 seedlings) segregation into I, 22 x 4 and I–II, 21 x 6.

K. 1085 plant 13 x A. 70 (N. 176) : (8 seedlings) segregation into I–II, 14 x 3 (1 seedling) and II, 20 x 7 (7 seedlings) : selfing of N. 176 : (2 seedlings) segregation into I, 20 x 4·5 and II, 22 x 7.

S. ALPINA x S. VULGARIS.

Three F_1 families : (8 seedlings) I–II, 22 x 6·5 ; five F_2 families (12 seedlings) ranged from I, 13·5 x 3 to II, 17 x 5·5.

S. GLAREOSA x S. ALPINA.

K. 1094 plant 11 x K. 1091 plant 4 (N. 173) : (1 seedling) I, 5·5 x 1·5 ; selfing of N. 173 : (1 seedling) I–II, 14·5 x 4·5.

K. 1094 plant 20 x K. 1085 plant 57 (N. 213) : (1 seedling) II, 15·5 x 6·5.

K. 1085 plant 57 x K. 1099 plant 32 (N. 203) : (2 seedlings) I, 16 x 3·5 and I–II, 15 x 5.

K. 1085 plant 5 x P. 9 (Tyrol) : (1 seedling) II, 17 x 5.

CROSSES INVOLVING S. GLAREOSA EMARGINATE VARIANT.

K. 1099 plant 41 x A. 13 (*maritima*) (N. 146) : (3 seedlings) II, 15 x 6 ; selfings of N. 146 : (12 seedlings) segregation, I, 22 x 3·5 (3 seedlings), I–II, 21 x 6 (6 seedlings), II, 19 x 7 (3 seedlings).

K. 1099 plant 41 x A. 70 (*maritima*) (N. 147) : (3 seedlings) II, 17 x 5·5 ; selfings of N. 147 : (10 seedlings) segregation, I, 25 x 5 (2 seedlings), I–II, 22 x 6 (7 seedlings), II, 23 x 7 (1 seedling).

N. 147 plant 6 x N. 147 plant 7 (N. 300) : (3 seedlings) I–II, 21 x 7·5.

N. 147 plant 6 x N. 104 plant 10 and plant 11 (*maritima*) : (12 seedlings) I, 22 x 4·5 (2 seedlings), I–II, 22 x 5·5 (7 seedlings), II, 21 x 6·5 (3 seedlings).

K. 1099 plant 41 x A. 15 (narrow *maritima*) (N. 148) : (4 seedlings) I–II, 18 x 6 ; selfings of N. 148 : (32 seedlings) segregation I, 33 x 6·5 (3 seedlings), I–II, 29 x 7 (27 seedlings), II, 23 x 7·5 (2 seedlings).

K. 1099 plant 41 x N. 18 plant 11 (*maritima*) (N. 149) : (3 seedlings) II, 18·5 x 6·5 ; selfing of N. 149 : (3 seedlings) segregation I, 16 x 4 (1 seedling) and I–II, 24 x 6·5 (2 seedlings).

N. 149 x N. 18 plant 11 (and selfing of this) : (16 seedlings) segregation, I, 24·5 x 5 (5 seedlings), I–II, 19 x 5·5 (8 seedlings), II, 18 x 6 (3 seedlings).

K. 1099 plant 41 x B. 37 (N. 154) : (3 seedlings) II, 20 x 7·5 ; selfings of N. 154 : (7 seedlings) segregation I, 22·5 x 3 (2 seedlings), I–II, 31 x 8 (2 seedlings), II, 25·5 x 9 (3 seedlings).

N. 154 plant 49 x N. 154 plant 25 and N. 154 plant 28 x N. 154 plant 25 : (5 seedlings) segregation I–II, 25 x 6 (3 seedlings), II, 21 x 7 (2 seedlings).

N. 154 plants x N. 121 plant 3 (Loch Tay) : (15 seedlings) I–II, 24·5 x 6·5.

K. 1099 plant 4 x N. 12 plant 251 (*vulgaris*) (N. 155) : (3 seedlings) II, 19 x 6·5 ; selfing of N. 155 : (3 seedlings) segregation I–II, 20 x 6 (1 seedling), II, 18·5 x 7 (2 seedlings).

N. 155 plant 1 x N. 155 plant 30 and N. 155 plant 36 : (8 seedlings) II, 22 x 8.

Crosses involving an Austrian mountain plant (C. 1).

N. 44 (C. 1 selfed) : (2 seedlings) I, 13 x 3.

A. 2 (*maritima*) x C. 1 (N. 41) : F_1 (10 seedlings) and F_2 (5 seedlings) : I–II, 22 x 6·5.

A. 15 (narrow *maritima*) x C. 1 (N. 45) : F_1 (4 seedlings) and F_2 (6 seedlings) : I, 31 x 4·5.

C. 1 x A. 21 (Welsh mountain *maritima*) (N. 51) : (2 seedlings) I, 22 x 6·5 ; N. 51 selfed ; narrow I, 24·5 x 4·5.

C. 1 x B. 11 (*vulgaris*) : I, 25·5 x 8.

Discussion and summary.

Two main cotyledon shapes are distinguishable. One is exemplified by N. 104, N. 18, and N. 14 and the other by N. 10, N. 99 and N. 204 (see plates). Generally speaking the narrower type with more gradual constriction below is characteristic of *Silene maritima* and of some stocks of *S. glareosa*. The broader type with abrupt constriction below is characteristic of *S. vulgaris* and *S. alpina*. Hybrids often shown an intermediate condition as exemplified in N. 88 right-hand seedling and N. 226 left hand seedling (see plate). Apart rom shape the width and surface area of cotyledons are frequently closely correlated with the corresponding characters as seen in the foliage leaves. Thus, the narrow-leaved *S. maritima* (N. 14), from the Portland end of Chesil Beach, has very narrow cotyledons while the broad-leaved *S. vulgaris* (N. 204) from the Pyrenees, has very broad cotyledons.

In some selfings, F_1 families, and F_2 families there is obvious segregation for cotyledon shape. Segregation on selfing is shown, for example, by N. 46 and in F_2 families by N. 88 and N. 226.

The research on which this paper is based has been aided by a Royal Society Government Grant.

Flowers of the Seasons.*—Each of these four little booklets of forty pages deals with flowers of one of the seasons giving descriptions in popular language under the names of the months in which they bloom. Brief notes on their introduction and culture are provided together with the derivation of the names accompanied by the author's line drawings (partially coloured) of the flowers themselves. Clear, simple and nicely produced, the author has not written a scientific treatise but has succeeded in producing four interesting little booklets which will appeal to flower lovers both young and old.

H.S.M.

*1. Flowers that Bloom in Summer. 2. Flowers that Bloom in Autumn. 3. Flowers that Bloom in Winter. 4. Flowers that Bloom in Spring. By Audrey Wyn ne Hatfield. (Seasonal Flower Books) London : Castle Press. 1949. Price 2/6 each.

Botany for Gardeners.*—In these days of advanced research when great strides have been made in the application of modern science to the improvement and extension of our " garden wealth ", this is a valuable publication. It brings to both the amateur and professional gardener an accumulation of facts and research work drawn from over three hundred books, many of which have been available to but relatively few specialists. The author R. P. Faulkner, who has himself had long experience of practical gardening, explains the correlation of pure science with the practice of horticulture and traces the history of the plant through all its ups and downs of life ; he uses technical scientific terms only where essential, and throughout describes the subject in a simple and clear manner. There is an adequate index and the text is illustrated with 53 black and white line drawings, diagrams and tables, and with eight photographic plates.

The book covers a wide range of work but emphasises plant physiology and its practical application. This is of greatest interest to the gardener as it shows the reasons for many of the necessities of good cultivation. The important part water plays in the life of the plant is fully explained, from its absorption by the roots to its loss through the stomata on the leaf. The mineral salts taken in with the water are required to build up a healthy plant, and as the formation of different parts of the cell depend on different elements, a continuous well balanced supply for selection by the plant must be available. The soil-less cultivation of plants is useful for certain crops subject to root or soil borne diseases, but otherwise appears to have little future.

An account of the structure of the plant deals first of all with the composition of the living cell, and then with the differentiation of tissue into roots, stems and leaves, many of which become specialised for a definite function. The increase of tissue goes on continuously in the living plant and internal as well as external modifications have to be made to accommodate this. Plant hormones are now known to play an important part in the initiations, rates and directions of growth and study of these has shown that similar synthetic substances can be used to induce or control growth. There is a chapter dealing with photoperiodism, an important factor in this country where there is such a difference between the length of day in summer and winter. Amongst other things it effects times of flowering, formation of storage organs and dormancy in plants.

Reproduction may be by vegetative propagation or by sexual multiplication, but both methods have their advantages and limitations. One of the latter is sexual sterility which may be due to incompatibility of the pollen, abortion or the sexual organs, or as in the case of hybrids, the inability of the chromosomes to pair at meiosis due to genetical dissimilarity. An understanding of the elementary factors of evolution and inheritance, genetics and cytology will help to explain how many of our largest and finest flowers, fruits, and vegetables have come into being. Mutations, hybridization and natural and man-made selection have been the origin of many new species and varieties.

This clearly compiled book should well be able to provide a general background of scientific knowledge sufficient for the amateur, or a foundation for the more detailed studies of the specialist.

P. Lewis.

*R. P. Faulkner, Botany for Gardeners. Frederick Muller Ltd. London, 1949. 12/6.

THE VALIDITY AND IDENTITY OF CHENOPODIUM GRAVEOLENS LAG. ET RODR.

J. P. M. Brenan.

Chenopodium graveolens was published by Lagasca and Rodriguez in Anales de Ciencias Naturales **5,** 70 (1802). The description formed part of a paper by the two authors entitled " Descripciones de algunas plantas nuevas que han florecido en el Real establecimiento botánico en el año 1801 ". *C. graveolens* Lag. et Rodr. raises two main questions which we are going to consider : firstly, whether the name is valid or not, and secondly, what Lagasca and Rodriguez' plant was, according to present-day taxonomy.

So far as I know, the legitimacy of *C. graveolens* Lag. et Rodr. was not questioned until Dr. P. Aellen, in a footnote on p. 105 of his paper entitled " Was ist das *Chenopodium graveolens* Willd. ? " published in Verhandl. Naturf. Gesellsch. Basel **41,** 105–8 (1930), wrote " da aber LAGASCA und RODRIGUEZ die binäre Nomenklatur in ihrem Artikel nicht anwenden, haben wir keinen Anlass, die Publikation im Sinne der " Nomenklatur-Regeln " anzuerkennen, um so weniger als die Autoren das " *graveolens* " in keiner Weise durch Typenverschiedenheit im Druck von den übrigen Wörtern der Beschreibung hervorheben lassen ". The name was actually first mentioned in the following way :—

" CHENOPODIUM graveolens foliis ovatis, oblongisque, sinuatis ; pedunculis dichotomis, axilaribus ".

It will be noted that the first two words are the generic name and an epithet agreeing with the generic name, the case then changing to the ablative. This way of setting out applies to all the species described by Lagasca and Rodriguez in their paper referred to. Where the authors refer to their species in the text they do so by a binomial consisting of the generic name and the first following word. Lagasca and Rodriguez' paper is not the sole instance of the use of this method about this time. Let us take some papers by Cavanilles (surely a user of binomial nomenclature !) in Anal. Hist. Nat. **1,** 89–107 (1799), where a precisely similar method is followed ; some of the plants are illustrated, and the captions to the plates use binomials separable from the diagnosis in the way mentioned above ; further, binomials made by other authors, e.g. *Goodenia ovata* Sm. (l.c., p. 94), *Goodenia laevigata* Curt. (l.c., p. 97), are made to precede their diagnoses in the same way, unseparated by punctuation or by difference of typography. At this time it was a frequent practice for the diagnosis to follow on after the binomial on the same line, but normally separated by punctuation or type. Lagasca and Rodriguez seem to have thought that they could dispense with these aids to the reader. While their method is obviously silly and most misleading, the circumstantial evidence is, I think, conclusive that they employed and intended to employ orthodox binomial nomenclature. It therefore follows from this that *Chenopodium graveolens* Lag. et Rodr. must be considered as a legitimate and validly published name.

The identity of *C. graveolens* Lag. et Rodr. must now be dealt with. As early as 1814 *C. graveolens* was made, at least in part, a synonym of *C.*

foetidum Schrad. (cf. C. F. P. Martius, Pl. Hort. Acad. Erlang. Enum. 74 : 1814), and this line seems to have been followed, with or without doubt, by standard works ever since, e.g. by Moquin in the Prodromus, by the Index Kewensis, and by Baker and Wright in the Flora of Tropical Africa. The fact was not faced that if this were so *C. graveolens* Lag. et Rodr., being earlier than *C. foetidum* Schrad., would be the correct name for this widespread African species.

In order to see whether the traditional synonymy was correct, a request for the loan of the type-specimen of *C. graveolens* Lag. et Rodr. was made to Madrid. It seems that none of the original plant actually described was kept. However, by the kindness and courtesy of the Director of the Jardín Botánico at Madrid, a specimen from Lagasca's own herbarium was sent, on whose label was written : " Chenopodium Nepaulense H. Berol. C. graveolens H. Matr. Floruit Octobri anni 1822 ". From the date on the label this of course cannot be the type-specimen, but I see no reason to doubt that this is authentic *C. graveolens* Lag. et Rodr., and indeed it is probably a lineal descendant of the original plant, since we know that *C. graveolens* Lag. et Rodr. was in cultivation over a period of years at this time both at Madrid and other botanical gardens of Europe. The specimen agrees satisfactorily with Lagasca and Rodriguez' original description, and for its time is a good one. There is no doubt whatever that it is *Chenopodium botrys* L.

C. botrys has been repeatedly recorded from tropical Africa, but I have seen no specimen from there and know of no satisfactory evidence for its occurrence. Plants so named usually prove to be *C. schraderianum* Schult. (*C. foetidum* Schrad. (1808), non Lam. (1778)) or *C. procerum* Hochst. ex Moq. *C. botrys* differs from *C. schraderianum* in the absence of a keel to the tepals and in the more highly polished seeds, not shagreened as in those of *C. schraderianum*, which under the compound microscope show a different sculpturing of the testa. And there are normally subtler and less easily definable differences in habit and leaf-cutting. In all these points Lagasca's specimen squares with *C. botrys*.

This specimen is, however, not the only evidence bearing on the identity of *C. graveolens* Lag. et Rodr. Jacquin, Eclog. Pl. Rar. **1**, p. 100, t. 67 (1811–16) has a full description and coloured plate of *C. graveolens*. Jacquin describes the tepals as tuberculose, and illustrates projections on the outer surface of the tepals ; I consider that these are clearly intended to represent the conspicuous glands of *C. botrys* and not the keel of *C. schraderianum*, especially as these projections are continued down the pedicel. Jacquin states that the University Garden at Vienna received seeds of *C. graveolens* in 1803 sent by Cavanilles from the Royal Botanic Garden at Madrid, and that the plant was communicated to several other botanic gardens. This is borne out by contemporary plant-lists. I feel little doubt that the plant illustrated by Jacquin was *C. botrys* L. in a luxuriant condition.

Dr. Aellen, however, maintains (*in litt.*) that Jacquin's plate portrays *C. schraderianum*. While admitting that the mode of branching of Jacquin's plant is perhaps more suggestive of *C. schraderianum* than of *C. botrys*, I consider that this is not a constant character and that it is outweighed by the evidence of the perianth, mentioned above. Dr. Aellen also writes

that he has examined plants in Herb. Stockholm (Herb. Swartz) whose seeds were sent from Madrid by Lagasca to Willdenów, and that they are certainly *C. schraderianum*. It is thus probable that both *C. botrys* and *C. schraderianum* were at that time passing under the name *C. graveolens* in botanic gardens.

If, as I suggest, the plant in Lagasca's own herbarium, although not a type, be taken to represent his concept of *C. graveolens*, then the latter name becomes a synonym of *C. botrys*. Otherwise, in the absence of a type, we must assume that both *C. schraderianum* and *C. botrys* were grown or sent out by Lagasca as his *C. graveolens*, which must thus be regarded as a *nomen dubium* ; Lagasca and Rodriguez ' original description is altogether unhelpful in making a choice between the two species concerned. Whichever view is taken *C. graveolens* Lag. et Rodr. is taxonomically invalid and is to be rejected.

The name *C. schraderianum* Schult., Syst. Veg. **6,** 260 (1820) (*C. foetidum* Schrad. in Magaz. Ges. Naturf. Freunde Berlin, 79 (1808), nom Lam., Fl. Fr. **3,** 244 : 1778) is used here in its traditional sense of applying to the tropical African species with keeled tepals ; this is the usage of the Flora of Tropical Africa, and of Dr. Aellen and Professor Ulbrich among recent writers on the genus. I have not seen Schrader's original description, and although Willdenow's almost contemporary account of *C. foetidum* Schrad. (Enum. Hort. Berol. 289 : 1809) is very short and does not mention the tepals, I feel it wise not to disturb the established usage until evidence can be found to disprove it. It should be noticed, however, that *C. foetidum* Schrad., a name still in common use, must be abandoned as being a later homonym—a fact recognised long ago by Schultes when he devised the name *C. schraderianum* to replace it.

Dr. Aellen, in Verhandl. Naturf. Gesellsch. Basel, **41,** 106 sqq. (1930), rejecting the name *C. graveolens* Lag. et Rodr. for reasons already discussed, uses the name *C. graveolens* Willd., Enum. Hort. Berol. 290 (1809) for a distinct American species for which Dr. Aellen had, in his previous " Beitrag zur Systematik der Chenopodium-Arten Amerikas " in Fedde, Repert. **26,** 39 (1929), used the name *C. incisum* Poir. However, *C. graveolens* Lag. et Rodr. being validly published, *C. graveolens* Willd. is a later homonym, and *C. incisum* Poir. in Lam., Encyl. Méth. **1,** 392 (1810) must apparently be restored as the correct name for the American species.

The conclusions reached in this paper may be briefly summarised as follows :—

(1) *C. graveolens* Lag. et Rodr. is a validly published name, its rejection on the ground of the non-employment by its authors of binomial nomenclature being due to a misapprehension.

(2) On the evidence of a specimen from Lagasca's herbarium, and of my interpretation of a plate in Jacquin's Eclogae Plantarum made from a plant said to have been grown from seed sent from the Madrid Botanic Garden, *C. graveolens* Lag. et Rodr. is conspecific with and thus a synonym of the European *C. botrys* L.

According to Dr. Aellen, plants in Herb. Stockholm from seed sent by Lagasca to Willdenow are certainly *C. schraderianum*, and he considers

Jacquin's plate also to be this species. On this view, since no type-specimen was kept and the original description is indefinite, *C. graveolens* Lag. et Rodr. must be rejected as a *nomen dubium* applied both to *C. botrys* and *C. schraderianum*.

(3) *C. graveolens* Lag. et Rodr. is thus not, as generally assumed, a synonym of the African species usually called *C. foetidum* Schrad. ; the latter name is a later homonym and the African plant must therefore be called *C. schraderianum* Schult.

(4) Although the original or contemporary descriptions of *C. foetidum* Schrad. and *C. schraderianum* Schult. are indefinite, it seems best to maintain their generally-accepted application to the African species until evidence against this is found.

(5) *C. graveolens* Willd. is a later homonym of *C. graveolens* Lag. et Rodr. The American species called by the former name must revert to its next available name which is apparently *C. incisum* Poir.

I must thank Mr. J. E. Dandy of the British Museum (Natural History), who first pointed out that *C. graveolens* Lag. et Rodr. was a legitimate name ; I am further indebted to Mr. Dandy for a transcription of the original description of this species.

Water in Plants.*—It is impossible to overate the importance of water in relation to plants, and thus there has grown up a very extensive literature on the subject so that, although some eight hundred references are cited in the work before us, the bibliography is far from exhaustive. Nevertheless the student will find here a most useful survey of work in this field, and the authors have admirably fulfilled their expressed aim to provide a reference work to this topic which should stimulate further reading. The introductory chapters on modern views of the structure of water and solutions are the more necessary, since physiologists are all too apt to treat of the moisture relations of plants as though water were a simple medium of a uniform character, uncomplicated in its functional effects by co-ordinations or binding forces. All types of bonding forces are probably involved, for example, in the phenomenon known as 'bound water', that has been held to play a part in drought and frost resistance, yet this has been treated as a separate state rather than a degree in a continuum of electrochemical forces. There are also useful chapters on osmotic phenomena, the water relations of the active cell, water uptake and movement, and the problems of water retention and loss. It is perhaps in these latter chapters that the reader may feel a more extended treatment would have been desirable to adequately meet the claim as a work of reference, which is obviously and probably desirably orientated from the physiological laboratory rather than the field, but a more extended treatment of the ecological aspects could have appreciably enhanced its value.

E.J.S.

*Water in the Physiology of Plants : by Crafts, Currier and Stocking. The Chronica Botanica Co., Waltham, Mass., U.S.A. ; Wm. Dawson & Sons, Ltd., London, W.C.2. Price $6.00.

CONTRIBUTIONS TO THE FLORA OF TROPICAL AMERICA : LI*.

On two Euphorbiaceae of British Guiana.

N. Y. Sandwith.

Haematostemon guianensis *Sandwith*, sp. nov. ; ab *H. coriaceo* (Bth. ex Baill.) Pax et K. Hoffm. foliis oblanceolatis apice abruptius acuminatis basi ipsa satis late et conspicue rotundato-cordatulis subauriculatis marginibus remotius atque multo minus obvie denticulatis, filamentis floris masculi basin versus dilatatis sed haud ut in *H. coriaceo* basi ipsa in glandulas tumidas obvias a sese distinguendas elevatis differt.

Arbor parva, ramulis junioribus pilis flavicantibus subadpressis pubescentibus. *Folia* oblanceolata, apice conspicue (1–1·5 cm.) satis abrupte acute acuminata vel cuspidata, basin versus sensim attenuata atque basi ipsa abrupte satis late (5–9 mm.) rotundato-cordatula atque plus minusve auriculata, 10·5–26·5 cm. longa, 3·4–7·8 cm. lata, chartacea, marginibus plus minusve sinuatis remote et plerumque obscure calloso-denticulatis denticulis a sese 0·7–1·5 cm. semotis, costa nervisque primariis inconspicue adpresse pubescentibus exceptis glabra, siccitate supra solemniter brunnea subtus multo pallidiora, costa supra tenuiter prominula subtus prominente, nervis primariis utroque costae latere 10–12 inferioribus angulo angusto acuto (c. 40°) alte subrecte ascendentibus ceteris latius arcuato-ascendentibus atque marginem versus anastomosantibus, his supra tenuissime prominulis subtus planis, nervis secundariis supra impressis subtus obviis planis pulchre parallelis, venulis utrinque impressis ; petiolus 3–5 mm. longus, copiose adpresse flavicanti-pubescens. *Racemi* axillares et terminales, inferne nudi, 8–14 cm. longi, graciles, saepe flexuosi, pubescentes ; flores inferne ♀, dissiti, tum ♂ fasciculati, flos terminalis ♀ ; bracteae lineari-lanceolatae, ad 1·5 mm. longae, basi circiter 0·4 mm. latae, saepius falcato-recurvae. *Flores masculi* pedicellis saepe flexuosis parce pubescentibus 2·5–3·3 mm. longis sustenti ; sepala 4, ovata vel ovato-oblonga, basi cohaerentia, acutiuscula apicibus inflexis, 1·3–1·75 mm. longa, 1–1·3 mm. lata, costa mediana elevata, intus crebre verruculosa, extra parce pubescentia ; stamina 4, filamentis 0·5–0·6 mm. longis basin versus gradatim dilatatis et basi ipsa cohaerentibus sed haud ut in *H. coriaceo* e glandulis tumidis obviis a sese distinguendis exorientibus, antheris usque ad 0·3 mm. longis. *Flores feminei* pedicellis 2–3·5 mm. longis dense albido-pubescentibus infra medium articulatis sustenti ; sepala ut videtur 4, scilicet 3 majora ovato-lanceolata obtusiuscula 1·5–2 mm. longa 0·8–1 mm. lata, interjecto quarto multo minore lanceolato 0·75–1·5 mm. longo 0·3–0·5 mm. lato, omnia extra pubescentia ; ovarium loculis globosis circiter 1 mm. diametro exalatis crebre obtuse verruculoso-muriculatis ; stylorum columna obovoideo-oblonga vel turbinato-clavata, 2·5–3·2 mm. longa, 1·75–2·2 mm. diametro, extra praesertim superne sparse pubescens praeterea superne leviter sulcata ceterum laevis, apice truncata atque depresso-concava, margine vel extra sub margine consociebus tribus dentium brevissimorum ad 0·2 mm. longorum obtusorum plus minusve conicorum praedita. *Fructus* non visus.

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*Cont. from K.B. 1949, p. 493.

British Guiana. Eagle Mountain, on watershed of Potaro and Konawaruk Rivers, in forest on lateritic ironstone soil, Jan. 25th 1943, *D. B. Fanshawe* in *Forest Department* no. 3859 : " 15 ft. tree of Kakaralli–Clump Wallaba forest ; leaves supple ; fls. in axillary and terminal spikes, pinkish-buff ; young fruit oblong, ribbed, green ".

Haematostemon, *Astrococcus* and *Angostylis* are three closely allied genera of the subtribe *Plukenetiinae*, until recently all monotypic and known only from the upper Rio Negro region near the borders of Brazil and Venezuela, where they occur as small monoecious trees up to about 20 ft. in height. The generic distinctions are taken from characters of the inflorescence, flowers and fruit. Mr. Fanshawe's very interesting new species certainly fits into *Haematostemon* on these characters, but the leaves resemble those of *Angostylis longifolia* Bth. and are not at all like those of *Haematostemon coriaceus* (Bth. ex Baill.) Pax et K. Hoffm. Moreover, the filaments of the 4 stamens of *H. guianensis* are dilated gradually and evenly to a scarcely disk-like centre where they cohere, whereas in *H. coriaceus* the filaments arise from conspicuous raised swollen disk-glands in the centre of the flower. The knobs at the top of the style column of the female flower of *H. guianensis* are very short and disposed in three distinct fields, and only 4 sepals have been observed. The related genus *Astrococcus* Bth., from which Pax and Hoffmann segregated *Haematostemon*, not only has remarkable horned carpidia, but also has a very different male flower : the 4 stamens are situated within a very distinct disk which is shallowly cup-shaped like a *Peziza*. The present writer found this disk to be continuous and irregularly sinuate with a raised thickened margin, not broken up into separate glands as described by Pax and Hoffmann. The third genus, *Angostylis* Bth., lacks the characteristic long spike-like inflorescence of the two others, its much larger male flowers with 3 sepals have about 20 stamens on a conical columnar receptacle, and the style column of the female flowers is deeply lobed.

Recently, in Bull. Torr. Bot. Cl. **75,** 403 (1948), a plant collected on the Tafelberg in Surinam was described by L. Croizat as a new species, *Angostylis tabulamontana*, but the author admitted that the genus was " entirely speculative ". Apparently, he had before him only branchlets, leaves and a single " submature " capsule. Whatever it may be, *A. tabulamontana* is certainly nothing like *Haematostemon guianensis* on account of its short narrow leaves which are cuneate at the base into a long petiole and have about 7 pairs of nerves.

Dodecastigma integrifolium (*Lanj.*) *Lanj. et Sandwith*, comb. nov.—*Pausandra integrifolia* Lanj. in Kew Bull. **1932,** 183 ; in Rec. Trav. Bot. Néerl. **33,** 769 (1936). *Dodecastigma mazarunense* Croizat in Bull. Torr. Bot. Cl. **75,** 404 (1948).

Prof. Lanjouw at first described this tree as a new species of *Pausandra*, making it the basis of a new section, *Pausandrella*, characterised by the trimerous flowers, with free sepals and petals, and the entire leaves. Four years later, in a revision of *Pausandra*, he excluded *P. integrifolia* and suggested the highly probable affinity of this species with the monotypic genus *Dodecastigma* Ducke, described in 1932, preferring to postpone transference until good material of the female inflorescence had been collected. In September, 1937, I re-collected the species in the type

locality on the lower Cuyuni River but found only two flowering trees, each with male flowers. Dr. Leon Croizat has now described a new species of *Dodecastigma* from British Guiana Forest Department (coll. Fanshawe) material with male flowers and fruit which agrees perfectly with *Pausandra integrifolia*. This material, from the Takutu Creek to the Puruni River, Mazaruni River, once again lacks the female flowers. The most recent collection is a fruiting one, *Forest Dept.* 5503, from the Kumakuma Creek, lower Mazaruni River, where the tree is common in the understorey of mixed forest.

Prof. Lanjouw agrees with me that the above new combination should be made without further delay. *D. integrifolium* is, indeed, strikingly similar to *D. amazonicum* Ducke both in the facies of its leaves and male inflorescence and in the general structure of its male flowers and fruits. As pointed out by Prof. Lanjouw, it is at once distinguished by the trimerous male flowers with fewer stamens. Further distinguishing characters have now been found in the male flowers and in the fruit. In *Forest Dept.* 4764 (a collection cited by Croizat) I found the three petals to be 7 mm. long and up to 6 mm. wide, ovate-elliptic (but not also obovate), with the margins incurved and the apex recurved, adpressed-pubescent all over the outer surface except near the margin. The 9 stamens had filaments much longer than the anthers, 3–3·5 mm. long, while the anthers were up to 1·3 mm. long. In *Herb. Jard. Bot. Rio* 23543 (the type collection of *D. amazonicum*), the four petals were smaller (6–6·3 mm. long, 4·5–5 mm. wide), ovate-orbicular (outer) and ovate-elliptic (inner, smaller). The 13–16 stamens had short filaments 1·5–2·5 mm. long, glabrous though sometimes becoming sprinkled with hairs from the densely clothed disk, about equalling (now a little shorter, now a little longer than) the anthers which were from 1·8 to 2·2 mm. long. Some of the sepals of both species have a membranous petaloid appendage at the apex : in *D. amazonicum* it is the two inner sepals which bear broad almost wing-like appendages broader than the laminae and more or less surrounding their upper third. In both species, again, the sepals are more or less united below, even in the open flower : they are not " free " in *D. integrifolium*, as described by both Lanjouw and Croizat.

The fruits and seeds of the two species seem to give good distinguishing characters, although these need testing by further collections. Lanjouw described the fruits of *Pausandra integrifolia* from the few very poor, quite immature examples which were available with the type material, but Croizat was able to give a description of the advanced capsules and seeds of *Forest Dept* 4878, and *Forest Dept* 5503, with dehisced cocci, is now at Kew. Mature dehisced fruits and seeds of *D. amazonicum* (*Herb. Jard. Bot. Rio* 24875, collected and determined by Ducke) are also represented at Kew so that a comparison can be made. The fruits of *D. amazonicum* are considerably larger than those of *D. integrifolium* at a comparable stage of development. The dehisced cocci of the former are 2·4 cm. high and 3 cm. broad, whereas the cocci of the latter are up to about 1·8 cm. high and 2·5 cm. broad. The seeds of the two species are quite distinct, on present evidence, in size, colour and markings. Those of *D. amazonicum* are, as described by Ducke, 2 cm. long, 1·8 cm. broad and 1·4 cm. thick, and they are brown with a darker brown, rather inconspicuous, irregular

mottling of lines and spots but lacking minute dots. The seeds of *D. integrifolium* are up to 1·6 cm. long, 1·3 cm. broad and 1 cm. thick, and are far more variegated in colour than those of *D. amazonicum* since the surface is pale brown while the conspicuous irregular mottling of lines and spots is black, and there is also a copious, fairly regular and very distinctive sprinkling of small black dots. The attachment scars are, of course, proportionately different in size in the seeds of the two species.

***British Plant Life.**—The author of this volume has devoted a great deal of attention to British Plants over a period of many years and in this work, which forms a notable contribution to the literature of the subject, he presents in a very thorough manner the knowledge and experience gained from his observations and protracted studies.

The book is divided into fourteen chapters ; after the introduction, the evolution of plant life, the influence of the ice age on our native flora, and the floristic changes of the post-glacial period are dealt with. A discussion of the present position and the geographical relationships of the British flora is followed by a consideration of plant communities, their development and modification. The author then goes on to deal, with variation, adaptation and natural selection, the study of heredity, and continuing changes in British plants. In the last chapter he suggests various lines of research for the future and finally emphasises the importance of the institution of National Reserves and National Parks, and the ownership of areas by the National Trust.

Profusely illustrated, the book contains fifty-three delightful colour photographs and twenty-seven others in black and white. In addition there are eight maps illustrating distribution, and one showing the botanical vice-counties. The seven appendices contain a list of vice-counties, technical guides to taxonomic methods, biometrics, ecological methods, basic outlines of cytology and genetics, and the more important county and local floras. A list of references to serve as a guide to students for further reading and as a check to information given in the text, is followed by a useful bibliography, a glossary of technical terms and a very complete index.

Dr. Turrill has gathered together within the compass of a single volume, a wealth of information illustrating modern trends of botanical research which will be read with great interest by all serious students of the British flora.

H. S. Marshall.

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*British Plant Life : by W. B. Turrill (New Naturalist Series) pp. xvii Æ 315, 53 col. & 27 uncol. ill., 8 maps. London : Colins, 1948. Price 21s. 0d.

ADDITIONS TO THE FLORA OF BORNEO AND OTHER MALAY ISLANDS: XXII.*

THE RHIZOPHORACEAE, BARRINGTONIACEAE AND CUCURBITACEAE OF THE OXFORD UNIVERSITY EXPEDITION TO SARAWAK, 1932.

H. K. AIRY SHAW.

RHIZOPHORACEAE

Carallia brachiata (Lour.) Merr. in *Philipp. Journ. Sci.* **15,** 249 (1919), et in *Trans. Amer. Philos. Soc.* n.s. **24** (2), 281 (1935).

Diatoma brachiata Lour. *Fl. Cochinch.* 296 (1790).

Carallia lucida Roxb. *Pl. Corom.* **3,** 8, t. 211 (1819) ; Merr. in *Journ. Straits Br. Roy. As. Soc.* **1921,** Spec. no., 421 (1921).

Dulit, river bank forest, under 300 m., 18 Aug., *Synge* for *Richards* 1332 : " Tree, *c.* 25 ft. [7·5 m.] high ".

Gynotroches axillaris Bl. *Bijdr.* 219 (1825) ; Merr. in *Journ. Straits Br. Roy. As. Soc.* **1921,** Spec. no., 420 (1921).

Dulit, forest by torrent, under 300 m., 24 Aug., *Native Collector* for *Richards* 1430 : " Small tree. Flowers greenish white ".

BARRINGTONIACEAE

Barringtonia (§**Butonica**) **rhodochlamys** *Airy Shaw*, sp. nov., affinis *B. curranii* Merr., quacum indumentum minutum ferrugineum receptaculi et calycis communem habet, sed ob bracteas magnas papyraceas rubras in genere distinctissima.

Arbor parva, 3–4 m. alta. *Folia* ingentia, oblanceolato-spatulata, fere metralia, usque 21·5 cm. lata, basi sensim angustata, in petiolum pro rata brevissimum (3–4 cm.) usque 1 cm. crassum decurrentia, apice . . . . (deficiente), margine integro vel minutissime et obscurissime denticulato, firme chartacea, glaberrima, costa valida utrinque prominente nervis primariis lateralibus circiter 60-jugis late patulis rectis basin versus crebris et valde plicato-bullatis prope marginem arcuato-anastomosantibus utrinque argute prominulis, nervis secundariis inter primarios plus minus scalariformiter dispositis cum minoribus reticulum conspicuum efformantibus. *Inflorescentia* (immatura) 26 cm. longa (teste *Richards*), pendula, rhachi valida usque 1·7 cm. crassa rugosa minute fulvo-furfuracea. *Bracteae* magnae, papyraceae, laete rubrae (teste *Richards*), plus minus ovatae vel orbiculares, valde convexae (velut ' inflatae '), usque 7 cm. longae et 4 mm. latae, crebre et sine ordine inter flores insertae, alabastra omnino obtegentes. *Flores* (ex alabastris submaturis tantum cogniti) in axi crebre inserti, subsessiles vel breviter stipitati, alabastro globoso usque 1·5 cm. diametro. *Calycis tubus* (' receptaculum ') obovoïdeus usque ellipsoïdeus, obtuse vel acute tetragonus, lateribus concavis, stipite (1–3 mm.) incluso usque 13 mm. longus, usque 6 mm. diametro, ut in *B. curranii* omnino minute ferrugineo-furfuraceus. *Sepala* 4, orbicularia, 1·7 cm. diametro, tenuissime herbacea, fere membranacea, pulchre venosa, valde concava. *Petala* 4, sepalis simillima, sed crassiora et paullulo minora. *Stamina* valde numerosa, in alabastro in massam globosam ± spiraliter disposita,

*Continued from *Kew Bull.* **1949** (2), 165 (1949).

antheris ellipsoïdeis vix 1 mm. longis. *Stylus* teres, circiter 2·5 cm. longus, stigmate punctiformi. *Ovarium* 4-loculare, dissepimentis tenuibus, ovulis in quoque loculo circiter 4 ab apice pendulis. *Fructus* ignotus.

Dulit, secondary forest, under 300 m., 23 Aug., *Richards* 1400 : " Tree, *c.* 3–4 m. high. Inflorescence 26 cm. long. Bracts bright red.

This remarkable species is unfortunately represented only by a single leaf, with the apex imperfect, and a very short section of the inflorescence (barely 1 cm.) with rather advanced flower-buds. In all characters except the bracts it appears to be closely allied to *Barringtonia curranii* Merr., a species known from Palawan and North Borneo (and also, according to Knuth, from Luzon), but in the large bright red papery bracts, disposed quite densely amongst the flowers, it differs from all other known species of the genus. Its evident close relationship to the more normal *B. curranii* precludes the erection of a separate section merely on the basis of the bract-character.

CUCURBITACEAE

Gynostemma simplicifolium Bl. *Bijdr.* 24 (1825) ; Merr. in *Journ. Straits Br. Roy. As. Soc.* **1921,** Spec. no., 585 (1921).

Dulit, forest by torrent, under 300 m., 24 Aug., *Native Collector* for *Richards* 1436 : " Small climber. Fls. green ".

NEW OR NOTEWORTHY SPECIES OF GONYSTYLUS AND RELATED GENERA.

H. K. AIRY SHAW.

The opportunity has recently been afforded of examining the material of *Gonystylus* preserved in the herbaria at the Forest Research Institute, Kepong, Malaya, and at the Botanic Gardens at Buitenzorg and Singapore, in connection with the account of this group to be written for the *Flora Malesiana*. As was to be expected, a number of undescribed species were found. Descriptions of those of which the material was adequate are supplied herewith, but there remain an equal, if not greater, number, represented by sterile specimens only, the description of which must await the eventual collection of flowering material. It is clear that the genus *Gonystylus* comprises a considerable number of species, but that many of them are distinguished mainly by somewhat obscure vegetative characters—size, texture, venation and indumentum of leaves, and especially colour on drying—characters often easy enough to observe but much less easy to put into words. Good characters are, however, often found also in the flowers—mainly in the shape of the sepals and in the number and setulose or glabrous condition of the petals—and it therefore appears unjustifiable to describe new species from sterile material, even though sterile material can usually be assigned with some confidence to its proper species.

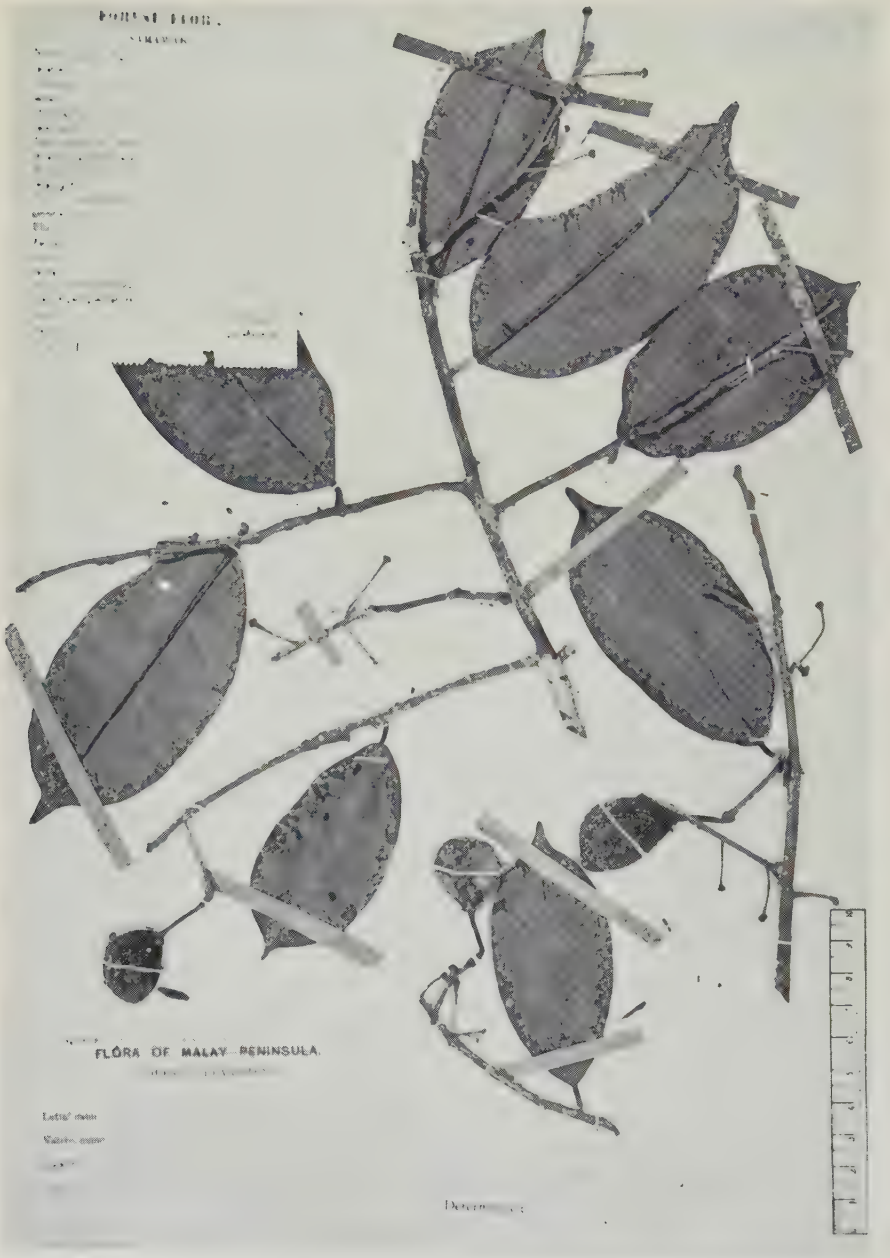
GONYSTYLUS SECT. EUGONYSTYLUS

Gonystylus brunnescens *Airy Shaw*, sp. nov., ob petala setulosa forsan *G. keithii* A.S. maxime affinis, sed foliis crassius coriaceis siccitate utrinque

Plate 5

Aëtoxylon sympetalum (v. St. et Domke) Airy Shaw. Flowering branch. Photograph of part of type collection (Herb. Kepong).

Plate 6



Aëtoxylon sympetalum (v. St. et Domke) Airy Shaw. Fruiting branches.
Photograph of Egon A. 0901 (Herb. Kepong).

castaneis (nec supra viridulis) crebrius parallelo-nervosis, floribus fere duplo minoribus, petalis haud pustulatis recedit.

Arbor 21–23 m. alta. *Ramuli* 3–4 mm. crassi, cortice striato fusco. *Folia* elliptica usque oblonga, 12–26 cm. longa, 4–10 cm. lata, basi ± cuneata usque rotundata, apice ± rotundata in acumen breve deflexum subabrupte angustata, margine reflexo, firme coriacea, siccitate utrinque castaneo-brunnea, glaberrima, supra 'chagrinata', subtus sub lente interdum nigro-puncticulata sed vix chagrinata ; nervi laterales numerosi, graciles, crebri, late patuli, prope marginem anastomosantes, utrinque prominuli ; venulae minores manifestae vel subtus subobscurae; petioli 12–15 mm. longi, 1–3 mm. crassi, rugoso-striati, juniores minute adpresse puberuli, mox glabri. *Inflorescentiae* terminales, simplices vel pauperrime thyrsoïdeae, 4–11 cm. longae, tenuiter adpresse ochraceo-pubescentes, fasciculis florum 1–2 cm. distantibus saepe breviter (usque 5 mm.) pedunculatis. *Pedicelli* circiter 5 mm. longi, dense adpresse ochraceo-pubescentes. *Flores* (an maturi ?) circiter 7 mm. diametro, dense ochraceo-sericei. *Calyx* basi truncatus et gibbosus ; *sepala* ovato-deltoïdea, 4–5 mm. longa, circiter 3 mm. lata, obtusiuscula. *Petala* 25–30, subulato-filiformia, circiter 3 mm. longa, extra glabra, intus ± dense retrorso-hispida, haud pustulata, inferne varie connata. *Stamina* brevissima, circiter tot quot petala. *Ovarium* subglobosum, circiter 4 mm. diametro, dense ochraceo-pubescens. *Stylus* circiter 3 mm. longus, glaber. *Fructus* (vix maturus) globosus, 3·5–4 cm. diametro, trilocularis, ut videtur indehiscens.

Malay Peninsula : Kemaman (Trengganu–Pahang border). Bukit Kajang, 150 m., 14 Nov. 1935, *Corner* 30462 (fl.) : " 60 ft. tree, slightly fluted at base, inner bark deep pinkish brown, fibrous, stripping, thick ; outer bark fuscous fawn, somewhat flaky fissured, v. faintly marked with rows of lenticels, not rugose, no leaf-scars, wood pinkish buff. Leaves with edges slightly recurved, dark green above. Sepals green. Petals (or corona of filaments) white. Stamens with v. slender white filaments and yellow anthers ; ovary pale yellowish ; style and stigma white ". Id. ibid., 15 Nov. 1935, *Corner* 30471 (fl.) : " 70 ft. tree, monopodial like a *Garcinia* or *Polyalthia* : branches crowded towards the top, passing obliquely upwards, not much curving out. Bark fuscous brown, rather fissured flaky but not very much, slightly scaly, uneven, finely and shortly creviced–fissured ; inner bark pale ochraceous white, rapidly browning on exposure, thick, the outer dead bark brown ; wood pale buff. Resembles a 'Polyalthia ' in habit and colour of bark, but no leaf-scars and bark is not smooth ".

Dutch Borneo : West Division. Melawi : B. Melaban Ketjie, 345 m. alt., 25 June 1939, *L. Budding* 326 (Boschbouwproefst. b.b. 28350) : " Tree, 21 m. high, a few examples together, on sandy clay, sloping ground, old primary forest, very common. Dayak name : *mahabai binjak* ". Melawi : Ng. Betoeng, B. Goentoek Kajan, 250 m. alt., 11 Oct. 1939, *L. Budding* 417 (b.b. 29629) (typus, Herb. Bogor.) : " Young tree, 22 m. high, scattered, on clay, sloping ground, old primary forest, rather common. Dayak name : *lemiar* ". Melawi : Ng. Betoeng, B. Moenggoek, 175 m. alt., 29 Jan. 1940, *Mas Soedarsono* 15 (b.b. 31633) : " Tree, 23 m. high, rather scarce, scattered, clay soil,

sloping ground, old primary forest. Dayak name : *gerima* ".—The following sterile specimens are also possibly referable here : *Boschbouw-proefst.* b.b. 8311 (*seriangoen*) (25 May 1925, *B. de Jong* 496/WB), and 11350 (*medang kelik*) (Paloh, 12 Feb. 1926, *Bianchi* 22).

Brunei. Pak Gabah (?), ridge, 7 May 1938, *For. Gd. Ba'ae* for *Flemmich* 34575 : " Height 45 ft., girth at breast height 3 ft. Vernacular name : *kelat* " [=*Eugenia, Syzygium*].

North Borneo. Mount Kinabalu : Dahobong river, c. 1050 m. 5 March 1933, *C. E. Carr* (Singapore Field No.) 26391 (fr., Herb. Singap.). Ibid., Gurulau Spur, jungle spur at tent corner, 1500 m., 4 Dec. 1933, *Clemens* 50705 (young buds ; Singap.) : " Tree, 15 inches by 50 feet. Buds only, on terminals, brown ".

This species is apparently near to *G. keithii* A.S., but differs in its more coriaceous leaves which dry more or less chestnut brown on both surfaces, those of *G. keithii* drying dull purplish-brown beneath and greenish above with a narrow dark purple margin. The petals of *G. brunnescens* are densely retrorse-setulose within, as in *G. Keithii*, but are non-pustulate. The flowers are subject to the attacks of a gall-making insect, galled flowers being present both on *Corner* 30471 and on *Budding* 417.

Gonystylus velutinus *Airy Shaw*, sp. nov., affinis *G. maingayi* Hook. fil. et *G. forbesii* Gilg, sed foliis subtus molliter velutino-pubescentibus, fructu subduplo majore distincta.

Arbor, statura ignota. *Ramuli* annotini fusci, plus minus tomentelli vel cito glabrescentes ; novelli dense fulvo-velutini. *Folia* plus minus elliptica, oblongo-elliptica vel lanceolato-elliptica, (6) 8–11 cm. longa, (2·5) 3·5–5 cm. lata, basi cuneata usque subrotundata, apice breviter sed anguste cuspidato-acuminata, cuspide 2–5 mm. longa, supra glabra, manifeste ' chagrinata ', subtus in statu juvenili dense fulvo-velutino-pubescentia, maturitate etiam saepe evidenter pubescentia, sed interdum tantum sub lente minute puberula, chartaceo-coriacea, siccitate obscure brunnea vel ochracea ; costa supra anguste canaliculata, subtus prominens ; nervi gracillimi, crebri, paralleli, late patuli, leviter procurvi vel subrecti, utraque pagina (sed magis infra) prominuli ; petiolus 7–11 mm. longus, 1–2 mm. diametro, supra anguste vel late canaliculatus, dense velutinus. *Inflorescentiae* terminales et axillares, 7–12 cm. longi, subfulvo-tomentelli, ramis 1–2 primariis ramulos complures brevissimos (usque 1 cm. longos) patentes racemose dispositos gerentibus, ramulis flores usque circiter 6 irregulariter gerentibus. *Flores* parvi, circiter 5 mm. diametro (expansi), pedicello 8–10 mm. longo tomentello insidentes ; alabastra ovato-acuminata, 3 mm. longa. *Calycis* tubus depresso-globosus, 3 mm. diametro, rugulosus, tomentosus ; segmenta deltoïdea, circiter 3 mm. longa, 3 latiora, 2 angustiora, acuta, valde revoluta, utrinque dense tomentella. *Petala* 7–8, deltoïdea, acuta, 2 mm. longa, incurva, glabra. *Stamina* ut videtur circiter 10. *Ovarium* subglobosum, 1·5–2 mm. diametro, dense setulosum, stylo filiformi glabro 3 mm. longo, stigmate clavato. *Capsula* lanceolato-oblonga, 3·5–5·5 cm. longa, valde lignosa, in valvas 3 (rarius 2) loculicide dehiscens ; valvae 1·3–2 (rarius 2·5) cm. latae, 5 mm. crassae, extra fusco-brunneae,

rugulosae, intus pallidae, sublaeves, maturitate late patentes vel subreflexae. *Semina* 1–3, lanceolato-ovoïdea, dorsiventraliter compressa, 2·5–3 cm. longa, testa fusco-brunnea laevi nitente, arillo oblongo circiter 8 mm. lato ventraliter carinato secus faciem internam per totam longitudinem extenso apice in appendicem breviter caudiformem producto.

SUMATRA. Palembang : sine loc. exact., 21 Jan. 1921 (foliage), 11 Oct. 1922 (v. young fr.), 21 and 25 Jan. 1923 (mature fr.), *L. J. W. Dorst* 15T/1P/21 ; vernacular name, *kajoe minjak* [*kayu minyak*=wood oil]. Ibid., 30 Oct. 1922 (foliage), 16 Oct. 1923 (fl.), 20 Jan. 1924 (fr.), 29 Apr. 1924 (seedlings), *L. J. W. Dorst* 15T/3P/812 (type) (presumably all from same tree) ; vernacular name, *oeloe toepai* [*ulu tupai*=squirrel's head]. Ibid., Moesi Iliren Koeboe region, 'Dekat doesoen Mangsang marga Koeboe-lalam, Tanggal,' 12 August 1934, *Pako* 7/VII (bb. 18655) (sterile) ; vernacular name, *kajoe minjak*.

The following, mostly sterile specimens are probably referable to this or a closely related species :—

SOUTH-EAST BORNEO. Sine loc. exact, 27 April 1927, *C. J. van der Zwaan* 132 (bb. 11184). Id., 7 May 1932, *A. Atjil* 252 (OB. 2444 ; bb. 16908) ; vernacular name, *lempong*. Noenoekan Island, Boeloengan, 5 m. alt., 6 May 1939, *G. H. Henar* 50 (bb. 293 or 29341) ; vernacular name, *tebakau poetih* [white *tebakau*].

WEST BORNEO. Melawie, Ngebel Betoeng, B. Moenggoek, ± 175 m. alt., on clay soil, sloping ground, old primary forest, rather scarce, scattered, 29 Jan. 1940, *Nas Soedarsono* 14 (bb. 31632) (fr.) : " Tree, 43 m. high, 52 cm. diam. ; vernacular name, *besiloeh*. Beloengai, 30 May 1932, *W. Wattimena* 1 (bb. 17012) (ster.) ; vernacular name, *babingkal*.

SARAWAK. Sine loc. exact. vel dat., *F.M.S. For. Dept.* C.F. 7159 : " Bark smooth, 1/4 inch thick. Sap irritates flesh. Wood fine-grained, whitish. Uses : planks, house construction ".

This species forms, with *G. maingayi* Hook. f. and *G. forbesii* Gilg, a small group characterized by the recurving of the sepals at anthesis. The leaves of *G. velutinus* in the young state are more strongly pubescent than those of any other species so far known.

Gonystylus pendulus *Airy Shaw*, sp. nov., inter species parvifolias foliis fere oblongis (cf. *G. maingayi* Hook. f.) 9–11 cm. longis 3–4 cm. latis, inflorescentiis parvis tantum 2–3 cm. longis, floribus pro rata majusculis 8–9 mm. diametro sepalis haud reflexis satis distinctus.

Arbor parva, ramis elongatis pendulis (teste *Clemens*), cortice ramulorum fusco-brunneo. *Folia* parva, elongate oblongo-elliptica vel fere oblonga, 9–11 cm. longa, 3–4 cm. lata, basi cuneata vel rotundato-cuneata, apice breviter caudata (cauda 6–8 mm. longa subacuta), chartaceo-coriacea, supra glaberrima, subtus brevissime (et in junioribus subsericeo-) adpresso-pubescentia, siccitate supra griseo-viridula, subtus pallide viridulo-ochracea vel fuscescentia et anguste ochraceo-marginata, fere epunctata ; costa gracilis, basin versus supra leviter impressa ceterum vix impressa, subtus prominens, juventute subsericea ; nervi laterales

numerosi, crebri, conspicui, valde reticulati, patuli et procurvi, 1–2 mm. a margine anastomosantes et nervum intramarginalem efformantes ; petioli 8–10 mm. longi, rugulosi, supra canaliculati, pubescentes. *Inflorescentiae* (? an semper) parvae, 2–3 cm. tantum longae, subsimplices, tenuiter adpresso-pubescentes vel subsericeae. *Pedicelli* elongati, 1–2 cm. longi, sericei. *Flores* pro rata majusculi, cremei (teste *Clemens*), siccitate leviter rosei. *Calyx* campanulatus, 8 mm. longus et 10 mm. diametro, crassus, extra breviter adpresso-sericeus, ultra medium divisus, segmentis late vel anguste ovatis circiter 6 mm. longis 2·5–4·5 mm. latis obtusis intus convexo-incrassatis dense setosis. *Petala* circiter 30, anguste subulata, inferne 'solida', superne magis applanata et subsulcata, acuta, circiter 5 mm. longa, glabra, epustulata. *Stamina* circiter tot quot petala, circiter 3 mm. longa, antheris oblongis. *Ovarium* globosum, circiter 2 mm. diametro, dense setosum. *Stylus* filiformis, elongatus, contortus, inferne plus minus setosus, stigmate subclavato-capitato. *Fructus* ignotus.

Sarawak. Mt. Poi, gorge of great rocks near upper zone, 1200 ft., 25 Sept. 1929, *M. & J. Clemens* 20011 (field no. 7125) : " Tree, 35 ft. high, 5 ins. diam. ; limbs pendent, viney ; flower cream ".

A distinct species, in its small almost oblong leaves, with close prominent reticulation, which somewhat recalls that of *G. forbesii* Gilg. In shape and reticulation the leaves are also not unlike smaller leaves of *G. punctatus* A. C. Smith, from Fiji. The small inflorescences, with relatively large flowers, which are externally shortly sericeous rather than tomentellous, are characteristic.

Gonystylus micranthus *Airy Shaw*, sp. nov. (aff. *G. Hackenbergii* Diels, teste Domke in sched. in Herb. Kepong), foliis subtus conspicue marginatis siccitate fusco-plumbeis, floribus parvis globosis 4–5 mm. diametro siccitate fuscis, petalis et staminibus circiter 10 in genere unicus.

Arbor circiter 18 m. alta, ramulis fuscis 3–4 mm. diametro glabris, novellis molliter breviter ochraceo-tomentellis. *Folia* elliptico-oblonga, 6·5–15 cm. longa, 3–6 cm. lata, basi rotundata vel latissime rotundato-cuneata, apice abrupte caudata (cauda 6–12 mm. longa circiter 2 mm. lata), anguste sed conspicue marginata, chartaceo-coriacea, siccitate fusco-purpureo-plumbea, subtus sparse puberula (costa densius), supra obscure (plerumque sub lente) puncticulata, haud 'chagrinata' ; costa subtus prominens, supra anguste insculpta ; nervi laterales numerosi, graciles, paralleli, late patuli, leviter procurvi, 1–2 mm. intra marginem anastomosantes ; venulae minores transversae numerosae ; petioli 8–10 mm. longi, 2–3 mm. lati, supra plani vel aperte canaliculati, glabri, fusci, subtus rugulosi, pubescentes. *Inflorescentiae* parum ramosae, usque 10 cm. longae, fasciculis florum 1–2 mm. stipitatis, molliter sed breviter ochraceo-pubescentes. *Pedicelli* graciles, usque 6 mm. longi, dense tomentelli. *Flores* in genere minimi (sed forsan nondum omnino maturi), globosi, 4–5 mm. diametro. *Sepala* ovato-deltoïdea, circiter 3 mm. longa, 1·5–2·25 mm. lata, subacuta, siccitate fusca, extra tenuiter puberula, intus dense sericea, basi in cupulam hemisphaericam connata. *Petala* circiter 10, subulata, 2–3 mm. longa, apicem versus ut videtur

paucipustulata. *Stamina* circiter 10, vix 2 mm. longa ; antherae oblongae. *Ovarium* circiter 2 mm. longum, dense fulvo-setulosum ; stylus filiformis, 3–4 mm. longus, valde geniculatus, stigmate parvo subclavato. *Fructus* ignotus.

Sarawak. Semengoh Reserve, hilly ground, 9 Feb. 1935, *D. Garvill* for *J. P. Mead* 00004 (Herb. Kepong et Singapore) : " Tree c. 60 ft. high, 2 ft. girth. Bark dark brown, smooth. Wood coarse grained, moderately heavy, [used for] planks ".

I have not yet seen the type of *G. hackenbergii* Diels, with which this species is compared by Dr. Domke, but from the original description (in Engl. *Bot. Jahrb.* **60,** 310 : 1926) it differs from *G. micranthus* in the smaller, glabrous leaves, drying a pale colour on both surfaces, with longer petioles, and in the petals and stamens being twice as many and " dentiform ".

The buds on the only specimen available are just beginning to open, and hence have probably not quite attained their mature dimensions, but they give the impression that they will probably not enlarge much further. If this is the case, the flowers are much smaller than those of any other known species. In its few petals it is comparable only with *G. bancanus* (Miq.) Kurz and *G. forbesii* Gilg, but in these the petals are considerably broader, and the leaves never dry the curious purplish-leaden hue of *G. micranthus*. The latter character occurs also in *G. calophyllus* Gilg and *G. confusus* Airy Shaw, and in an undescribed species from the Lingga Archipelago, but these species differ widely in other respects.

Gonystylus Sect. Auxanthus

Gonystylus augescens Ridl. in *Kew Bull.* **1946,** 43 (1946) ; Airy Shaw in *Hook. Ic. Pl.* **35,** t. 3474 (1947).

An older fruit than that described and figured in *Ic. Pl.*, l.c., but still immature, is present on the Singapore specimen of *Haviland* ' d.c.q.a. ' (=no. 488 in Herb. Kew, no. 29 in Herb. Singap.). It does, however, confirm that this type of fruit is probably normal for the species, and a description and drawing (fig. 1) are supplied herewith).

Fructus vetustior ut ille valde immaturus jam descriptus (*Hook. Ic. Pl.* t. 3474), sed latius lanceolatus, 5·5 cm. longus, 2·2 cm. latus, trivalvis, ± sexcostatus, costis locularibus late convexis vel obtuse carinatis, costis suturalibus angustis canaliculo tenui percursis in apicem crasse trialatum brevissime trigibbum desinentibus, glaber, sub lente minute rugulosus et velut pruina pallide brunnescente obductus, calyce vix aucto circa basin persistente.—*Folia* usque 29 cm. longa. *Bracteae* usque 6–7 mm. longae, oblongae, ± cucullatae vel cymbiformes.

Aetoxylon, gen. nov.

When proposing the Section *Aëtoxylon* for *Gonystylus sympetala* van Steenis et Domke, in *Kew Bull.* **1947,** 10, I had seen no material of this interesting plant, but realised from the original description that it must be a remarkably distinct species. Having now been able to examine material from the Forest Research Institute, Kepong, including a duplicate of the type (see Plates 5 and 6), I have no hesitation in raising the section to generic rank. It is almost as distinct from *Gonystylus* as is

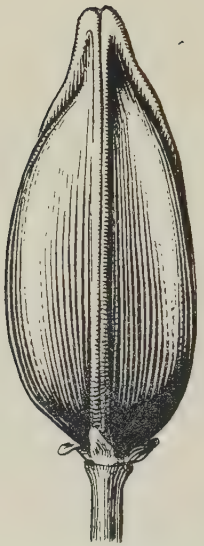


FIG. 1. *Gonystylus augescens* Ridl. Fruit, perhaps 3/4 grown. (Nat. size).

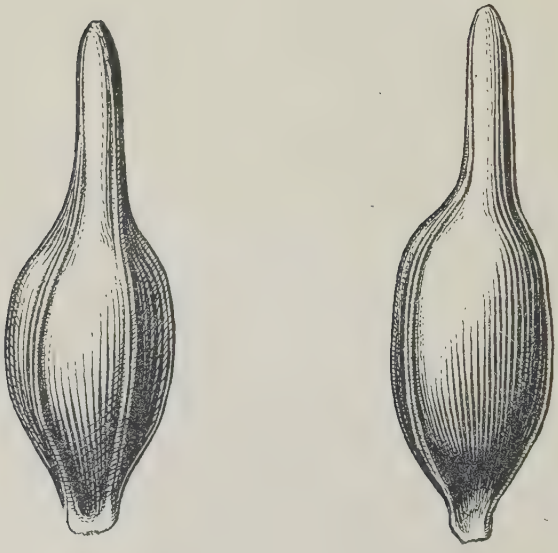


FIG. 2. *Amyxa pluricornis* (Radlk.) Domke.
Fruits, perhaps 3/4 grown : left with 4 ridges ; right with three ridges. (Nat. size).

Amyxa [van Tiegh.] Domke. The texture and venation of the leaves, the opposite or subopposite arrangement of the leaves and branchlets, the umbellate inflorescence, the annuliform corolla, and the rather small, irregular, verruculose, velutinous fruit, are widely different from the conditions found in either of the other genera.

Aëtoxylon (*Airy Shaw*) *Airy Shaw*, gen. nov. (Thymelaeaceae–Gonystyloïdeae), a *Gonystylo* Teijsm. et Binnend. ramulis foliisque oppositis vel suboppositis, nervatione laxo et saepe obscuro, unde folia subtus laevia et sublucida, floribus umbellato-congestis, sepalis reduplicato-valvatis, corolla ad annulum membranaceum humillimum redacta, fructu (immaturo) saepe irregulari verruculoso breviter velutino differt.—*Gonystylus* Sect. *Aëtoxylon* Airy Shaw in *Kew Bull.* **1947** (1), 10 (1947).

Calyx cupularis, ultra medium 5-lobus, lobis suberectis oblongo-triangularibus obtusis. *Corolla* ad annulum membranaceum erectum humillimum integerrimum glabrum redacta. *Torus* more *Gonystyli* setulis erectis flavidis dense vestitus. *Stamina* 10–14, brevissima, antheris hippocrepidiformibus. *Ovarium* subglobosum, dense pubescens, 4-loculare (an semper ?) ; stylus filiformis, elongatus, inferne sparse pilosus, stigmate capitato. *Fructus* (immaturus tantum notus) loculis saepe abortis irregulariter subglobosus vel subpyriformis, verruculosus, breviter velutinus. *Semina* nondum examinata.

Arbor alta. *Rami* teretes, longitudinaliter striatuli, cortice fusco; ramuli oppositi vel suboppositi saepe angulo fere recto divaricati, novellis velutinis. *Folia* opposita vel subopposita, petiolata, coriacea, elliptica vel saepe leviter obovata, penninervia, nervatione laxa supra immersa et inconspicua. *Inflorescentia* ex umbellis longipedunculatis subracemose dispositis sistens, umbellis usque 6-floris, pedunculis rectis sulcatis apicem versus nodoso-incrassatis.

Species adhuc unica, Borneonis occidentalis incola.

Aëtoxylon sympetalum (*van Steenis et Domke*) *Airy Shaw*, comb. nov.

Gonystylus sympetala van Steenis et Domke in *Notizbl. Bot. Gart. Berlin*, **12,** 233 (1934), et apud Domke in *Biblioth. Bot.* **27,** Heft 111, 7, 33, 145, t. I, fig. 3 (1934) ; Airy Shaw in *Kew Bull.* **1947** (1), 10 (1947).

Sarawak. Stapok Forest Reserve, 'munggu,' fr. 28 March 1941, *Egon* A. 0901 : " Tree, 60 ft. high, 30 in. girth. Fruit red. Bark dark ". Vernacular name : *ramin batu.*

Western Dutch Borneo. Sanggau : Kampoeng Mawa (Ginis), ± 100 m. alt., old forest, flat land, sandy soil, 23 Dec. 1932, *Soelaiman* 9 (bb. 17222) (type) : " Tree, 27 m. high, 40 cm. girth. Scarce. Flower buds green, odour unpleasant, taste moderate. An oil is obtained from the heartwood (*minjak garoe-laka*)." Vernacular name : *kajoe laka* or *garoe laka.* Sambas, n.d., *van den Hout* s.n. (fr. ; not seen ; *ex* van Steenis et Domke). Sine loc., 4 June 1932, *Schuitemaker* W.B. 176 (bb. 16703) ; vernacular name, *melebajan.*—Also probably (*teste* v. St. et Domke) : Palo, 26 July 1920, *Becking* 16 (bb..... ?).

AMYXA

Amyxa pluricornis (Radlk.) Domke.—Vide *Hook. Ic. Pl.* **35,** t. 3475 (1947).

Additional material seen :

SARAWAK. Tebon, Sadong, hilly ground, 24 April 1927, *Daud* A. 0039 (fl. ; Kepong) : " Tree 20 ft. high, 18 in. girth. Wood used for planks". Vernacular name, *ramin bukit* [=hill *ramin*]. Nanga Pelagos, 25 July 1938, *Daud & Tachun* 35650 (fr. ; Singap.) : " 20 ft. tall. Fruit yellow-green ". Gunong Gading, 8 Sept. 1938, *Daud & Tachun* 36092 (fl. ; Singap.) : " 50 ft. tall. Flower yellow ". Vernacular name, *ramin batu* [stony *ramin*]. Ibid., hilly ground, 8 Sept. 1938, *Egon* 0652 (fl. ; Kepong) : " Large, 50 ft. high, 3 ft. girth ; flower red ; bark red ; used for planks". Vernacular name, *ramin batu.*

It was satisfactory to find, on the two sheets of *Daud & Tachun* 35650 in Herb. Singapore, fruiting material of this apparently rarely fruiting species. It is possible that these fruits are not quite mature, but they cannot be far short of it, and their shape, as may be seen from the drawing (fig. 2), is very remarkable. A description follows.

Fructus breviter subcompresse ellipsoïdeo-oblongus, breviter stipitatus et longe rostratus, 5·8–6·8 cm. longus, rostro excluso 4–4·5 cm. longus, 2 cm. latus, 1 cm. crassus, rostro cylindrico 2–2·5 cm. longo 5–6 mm. diametro, sulcis (? 2–) 3–4 longitudinalibus marginibus elevatis paria costarum tenuium contiguarum efformantibus percursus, totus brevissime brunneo-velutinus, basi calycis segmentis persistentibus immutatis reflexis vel patentibus ornatus, pedicello incrassato.

All the above material is referable to the first of the two groups referred to in *Hook. Ic. Pl.*, l.c.—i.e. to the ' typical ' form. The localities all lie in the Kuching (First Division) area of south-western Sarawak. In the light of recent experience with specific distinctions in *Gonystylus*, I have now little doubt that the form represented by the second group there mentioned, comprising the *Clemens* specimen from Sungei Gaat, Central Sarwak (Third Division), and the *Richards* specimen from Mount Dulit (Fourth Division), further north, represents a distinct species. The differences between these groups are quite of the same order as those found in *Gonystylus*, and I therefore subjoin a formal description of this second species of *Amyxa.*

Amyxa taeniocera *Airy Shaw*, sp. nov., ab arcte affini *A. pluricorni* (Radlk.) Domke pube undique brevissima adpressa minute sericea nec patule tomentella, foliorum costa supra plana vel vix impressa, inflorescentiis ut videtur magis elongatis, petalorum setulis omnibus retrorsis adpressis, ' parastylis ' applanatis loriformibus erectis satis distincta.—*A. pluricornis* (Radlk.) Domke sec. Airy Shaw in *Bull. Misc. Inf.*, Kew, **1940** (6), 261 (1940) et in *Hook. Ic. Plant.* **35,** sub t. 3475 (1947), quoad *Clemens* 21687 et *Richards* 1604, non (Radlk.) Domke ; *Hook. Ic. Plant.* t. 3475, figs. 4a et 8a !

Arbor 15 m. alta (teste *Clemens*), c. 30 cm. diametro (teste *Richards*). *Ramuli* graciles, teretes, glabri, novellis minute adpresso-sericeis. *Folia* late oblongo-elliptica vel elliptica, 12–16 cm. longa, 4·5–6·5 cm. lata, basi subrotundata et in petiolum subabrupte breviter angustata, apice

breviter acuminata, tenuiter chartacea, glaberrima (nisi costa subtus interdum parcissime puberula), siccitate ± pallide brunnea vel juniora viridula, utrinque minutissime, subtus dense et supra densissime, punctata ; costa subtus prominens, supra plana vel vix impressa ; nervi laterales gracillimi, 8–10-jugi, patuli, procurvi, marginem versus reticulatim anastomosantes, subtus prominuli, supra inconspicui ; venuli minores e costa magis patentim orti ; petioli graciles, 10–13 mm. longi, rugulosi, minute puberuli. *Inflorescentiae* elongate laxe thyrsoïdeae, usque 27 cm. longae, graciles, minute adpresse sericeae, ramis late patentibus usque 5 cm. longis, rhachi et ramis varie complanatis vel angulatis, bracteis linearibus usque 8 mm. longis adpressis, pedicellis 6–9 mm. longis sericeis. *Flores* iis *A. pluricornis* simillimi, sed petalorum setulae omnes adpresso-deflexae (nec superne patentes) et ovarii ' parastyli ' applanati, taeniiformes, erecti. *Fructus* ignotus.

Sarawak. Sungei Gaat, Upper Rejang River, forest slopes, 1929, *J. & M. S. Clemens* 21687 : " Tree, 50 ft. ; fl. green-yellow ". Near Long Kapa, Mount Dulit (Ulu Tinjar), primary forest on hillside, under 300 m., 3 Sept. 1932, *Richards* 1604 (typus, Herb. Kew.) : " Tree, c. 30 cm. diam. Fls. greenish-white, sweet scented. Vernacular name, *soma merah* " [=red *soma*).

FURTHER NOTES ON WEST AFRICAN ANCISTROCLADUS

H. K. Airy Shaw.

Dr. J. Léonard, of Brussels, has kindly drawn my attention to an unfortunate error in my note on " *Ancistrocladus barteri* " in *Kew Bull.* **1949** (1), 67 (1949), in which I stated that this name was first published by van Tieghem in 1903. This was quite erroneous : as Dr. Léonard points out, it was first published, with a proper Latin description, by G. F. Scott Elliot, in a paper " On the Botanical Results of the Sierra Leone Boundary Commission ", in *Journ. Linn. Soc.*, Bot., **30**, 73 (1894), which I had entirely overlooked. Of this work van Tieghem seems also to have been unaware, when publishing his species, nor is any reference to it made in the *Flora of West Tropical Africa* ; and my failure to take account of it was due to this fact. (See also Léonard in *Bull. Soc. Roy. Bot. Belg.* **82**, 29 : 1949.)

Scott Elliot cited under *Ancistrocladus barteri* two of his own Sierra Leone specimens, nos. 4860 and 4797, which clearly formed the main basis of his description ; and, as a kind of afterthought, " also " *Barter* 1699, from Southern Nigeria. He gave no indication of type, nor any formal statement of the differences from *A. guineënsis* Oliv. *Scott Eliot* 4860 is one of the specimens referred in my paper to the " Sierra Leone race " of *A. guineënsis*, while *Scott Elliot* 4797 is referred to *A. abbreviatus* A. S. In his description of *A. barteri*, however, Elliot mentions a significant point of distinction between *A. barteri* and *A. guineënsis*, which I had altogether missed. He writes : " foliis . . . ad basin angustatis, margine valde revoluto (haud more *A. guineënsis* involuto)". This appears to be a good character, and sharply separates the Sierra Leone " guineensis " from the true *guineënsis* of S. Nigeria. Scott Elliot's description of the inflorescence of *A. barteri* as " Paniculi dichotomi 18 cm. longi-et 12 cm. lati " is

also clearly based on his (flowering) specimen no. 4860 (" guineensis "), not on his no. 4797 (*abbreviatus*). His description of the fruit, " obpyramidale 5-angulare, costis incrassatis, sine calycis lobis 15 mm. long. et 15 mm. lat.", is, however, based on the fruiting specimen of *A. abbreviatus*, no. 4797. (The fruit of *A. abbreviatus* is figured in Hutch. et Dalz., *Fl. W. Trop. Afr.* **1** (1), 196, fig. 86 D : 1927.)

Taking all the circumstances into consideration, it will probably be best to select *Scott Elliot* 4860 as the lectotype of *A. barteri* Scott Elliot (non van Tiegh.). This will enable this name to stand for the Sierra Leone plant, which is closely related to *A. guineënsis* but is apparently a distinct species, distinguished by the revolute, not involute, leaf-margin, and certain less easily defined characters of venation and inflorescence (cf. p. 69, *supra*). *A. guineënsis* is thereby restricted to Nigeria. *A. barteri* van Tiegh. (non Scott Elliot), being based exclusively on the sterile *Barter* 1699 from Onitsha, S. Nigeria, remains problematic, for the leaf-margins are, as noted by Elliot, *re*volute as in the Sierra Leone plant, not *in*volute as in the remaining Nigerian material. It is very probable that it represents a sixth West African species, since Dr. Léonard has lately described* three new species from the Belgian Congo. A recent collection (*Jones* [F. H. I.] 621) from Onitsha, almost certainly conspecific with Barter's, appears to indicate a species related to *A. likoko* Léonard (*l.c.* 34, t. 1, H-J).

Revised citations for *A. barteri* are given below.

Ancistrocladus barteri Scott Elliot in *Journ. Linn. Soc., Bot.*, **30,** 73 (1894), pro parte ; excl. *Scott Elliot* 4797 et descr. fruct. ; Hutch. et Dalz., *Fl. W. Trop. Afr.* **1** (1), 196 (1927), pro parte.

? *A. barteri* van Tiegh. in Morot, *Journ. de Bot.* **17,** 154 (1903), *nom. provis.*

? *Ancistrella barteri* van Tiegh. *l.c.* 155 (1903).

[*Ancistrocladus guineensis* Oliv. sec. Airy Shaw in *Kew Bull.* **1949** (1), 68 (1949), quoad specim. e Sierra Leonis, non Oliv.]

Sierra Leone. *Scott Elliot* 3841 (not mentioned by Elliot), 4860 (lectotypus!) ; *Deighton* 3815, 3885 (for details see *K.B.* **1949,** 69).

Liberia. Grand Cape Mount Co. : Genna Tanyehun, 21 Dec. 1947, *J. T. Baldwin Jr.* 10756 : " High climber (sterile) ".—Probably this : Central Prov., Sanokwele Distr. : Ganta, by St. John River, 1 Feb. 1948, *J. T. Baldwin Jr.* 11016 : " High climber ".

The following is a rough key to the known West African species of *Ancistrocladus* :

Inflorescence very short and congested, 1–2 cm. long ; fruit obconic, 1·5 cm. long, with short, thick, erect wings ; leaf-margin at base revolute (Sierra Leone, Liberia, Gold Coast) . . . . . **A. abbreviatus** Airy Shaw†

*Une nouvelle et curieuse famille pour la flore phanérogamique de Congo Belge : les Ancistrocladaceae. *Bull. Soc. Roy. Bot. Belg.* **82** (1), 27–40 (1949).

†I take this opportunity of citing *Deighton* 2589, from Njala, Sierra Leone, as the type of *A. abbreviatus* ; this citation was inadvertently omitted in *K.B.* **1949** (1), 68 (1949).

Inflorescence loosely cymose, with elongate branches :

Leaves small, under 8 cm. long, abruptly contracted at base ; leaf-margin at base revolute ; fruit unknown (S. Nigeria) . . . .
A. uncinatus Hutch. et Dalz.

Leaves large, over 10 cm. long, gradually narrowed to base :

Leaf-margin at base involute ; venation less strongly reticulate ; fruit subglobose, under 1 cm. long, with 3 long and 2 shorter thin spreading wings (S. Nigeria) . . . **A. guineënsis** Oliv.

Leaf-margin at base revolute ; venation more strongly reticulate ; fruit unknown :

Leaves contracted at base into narrow " pseudo-petiole " ; venation very lax, nerves about 7–8 pairs ; intramarginal nerve none ; inflorescence-branches relatively short and slender, flowers small, crowded towards the tips (Sierra Leone, Liberia) . . . . . **A. barteri** Scott Elliot

Leaves uniformly narrowed to base, without " pseudo-petiole "; venation crowded, nerves about 20 pairs ; intramarginal nerve distinct ; inflorescence-branches very long and rather thick, flowers relatively large, arranged rather distantly along most of length of branches (Liberia) . . . . . .
A. pachyrrhachis Airy Shaw (*infra*)

Ancistrocladus pachyrrhachis *Airy Shaw*, sp. nov., *A. barteri* Scott Elliot affinis, sed foliis basi minus abrupte angustatis (i.e. vix 'petiolatis') nervis crebrioribus plus duplo numerosioribus, nervo intramarginali distincto, inflorescentiis majoribus basi plerumque foliis specialibus redactis comitatis, rhachibus elongatis saepe bis terve tantum furcatis vel etiam simplicibus crassiusculis subteretibus dissitifloris, floribus plus duplo majoribus bene distincta.

Frutex alte scandens, caulibus teretibus, cortice laevi brunneo interdum leviter cinereo-pruinoso tandem longitudinaliter striato-fisso, uncis plerumque infra inflorescentias sitis. *Folia* oblanceolata, 10–25 cm. longa, 3–7 cm. lata, basi cuneato-angustata 5–6 mm. lata vix ' pseudo-petiolum ' brevissimum efformantia, apice subobtusa vel brevissime acutata, margine anguste reflexa, chartaceo-coriacea, glabra, siccitate brunnescentia, costa subtus tereti valde prominente supra levissime impressa, nervis lateralibus primariis gracilibus patulis subrectis valde numerosis (20–25-jugis in folio maximo), plerumque cum nervis minoribus secundariis parallelis alternantibus, 3–4 mm. a margine in nervum intramarginalem conspicue anastomosantibus, rete nervorum ceterum ei *A. barteri* Scott Elliot simili. *Inflorescentia* ampla, 15–35 cm. longa, ramis primariis 3–5, his plerumque bis terve furcatis interdum simplicibus, ramulis elongatis fere per totam longitudinem remotiuscule floriferis floribus 1–1·5 cm. inter sese distantibus pedicellis persistentibus conspicuis, rhachibus teretibus crassiusculis (fere per totam longitudinem 1–1·5 mm. crassis apicem versus parum vel vix attenuatis) ; inflorescentia basi foliis parvis specialibus (vel bracteis) 3–10 oblanceolato-spatulatis 2–7 cm. longis comitata. *Flores* pro genere majusculi ; pedi-

celli 2–4 mm. longi, late patuli vel arcuato-patentes, rigidi, persistentes, apice articulati conspicue discoïdeo-expansi ; alabastra globoso-pyriformia, sub anthesin 6–7 mm. longa. *Sepala* inaequalia, 2 exteriora latissime obovata fere orbicularia circiter 5–6 mm. longa, 2 interiora late elliptico-obovata 6–7 mm. longa, quintum situ et forma intermedium, omnia apice rotundata, basi plus minus inter se et cum ovario coalita et valde imbricata et in stipitem brevem cuneato-angustata, crassiuscula, rigida, dorso more generis glandulis foveiformibus paucis conspicue notata. *Petala* alabastro obovata, sed anthesi ineunte elongantia, elliptico-oblonga, 8–9 mm. longa, 3–3·5 mm. lata, apice rotundata, reflexo-patentia. *Stamina* 10, per paria petalis opposita iisque basi adnata, 5–6 mm. longa, basi incrassata, superne attenuata, antheris parvis ovatis vix 1 mm. longis. *Styli* 3, teretes, 4–4·5 mm. longi, valde caduci, in mamma humili depresso-conica insidentes, stigmatibus parvis capitatis. *Fructus* ignotus.

Liberia. Montserrado Co. : Monrovia, sandy area, 30 May 1947 and 7 Jan. 1948, *J. T. Baldwin Jr.* 5839 (typus, Herb. Kew.) and 10984 (both from same plant) : " Scandent shrub, about 10 feet high ".

This appears quite distinct from the four West African species so far known. It is nearest to *A. barteri* Scott Elliot, but the close venation, distinct intramarginal nerve, less abruptly attenuate leaf-base, elongate comparatively thick inflorescence-branches and larger distantly arranged flowers immediately separate it. It is remarkable that this plant from the well-collected neighbourhood of Monrovia should have hitherto escaped detection. Mr. Baldwin now writes (10 Sept. 1949) that this particular specimen has unfortunately almost certainly " been cut either for firewood or because it was on a prospective house site. I have searched for the plant several times. It grew in a sandy area within the limits of Monrovia . . . In my walkings throughout this country I never saw a second plant ". It is evidently an extremely local species.

Drawings of British Plants.*—Three parts of this work have now been published. The first part, devoted to *Ranunculaceae*, contains 44 plates, while the second, dealing with *Berberidaceae*, *Nymphaeaceae*, *Papaveraceae* and *Fumariaceae* has 22. In the third part, which has recently appeared, the author has depicted the British representatives of *Cruciferae* in 77 excellent drawings which maintain the high standard usually associated with Miss Ross-Craig's work. As in the previous numbers, the various parts of each plant are clearly and accurately shown and the numerous enlarged figures of floral and vegetative details (the scale being indicated against each) will be found particularly useful when dealing with this difficult group of plants. Each plate is accompanied by a full explanatory legend including the common name and colour of the flowers. It is evident that this work, which commences a series of uniform and critical botanical drawings long needed by the keen student of the British flora, has been carefully prepared and well-produced, and reflects great credit on artist, block makers and publishers alike.

H.S.M.

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*Part I. *Ranunculaceae* (44 plates), 1948. Price 6/-. Part II. Berberidaceae, *Nymphaeaceae*, *Papaveraceae*, *Fumariaceae* (22 plates). 1948. Price 4/6. Part III *Cruciferae* (77 plates). 1949. Price 9/-. London : G. Bell & Sons, Ltd.